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**Rocky Mountain
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General Technical
Report RM-88

Social and Environmental Consequences of Natural Resources Policies

With Special Emphasis on Biosphere Reserves

Proceedings of the International Seminar

April 8-13, 1980 Durango, Mexico

Foreword

The Man and the Biosphere (MAB) National Committee of the United States, in cooperation with the Government of the State of Durango, Mexico, and the Institute of Ecology, Mexico City, hosted an international seminar on the "Social and Environmental Consequences of Natural Resources Policies, with Special Emphasis on Biosphere Reserves," in Durango from April 8 to April 13, 1980. The objective of this seminar was to promote international cooperation among natural resources policy makers, scientists, and educators within the framework of the international MAB Program. In addition to the hosts mentioned above, primary support for the seminar was furnished by the Office of Science and Technology in the U.S. Agency for International Development (AID). Additional support has been provided by the School of Renewable Natural Resources at the University of Arizona, Tucson, and by the Rocky Mountain Forest and Range Experiment Station of the United States Department of Agriculture.

Through the seminar, a dialogue was initiated among upper level policy makers, scientists, and educators from both developing and developed countries on social and environmental consequences of natural resources policies. Over 65 participants from Mexico, Central America, and the United States attended the seminar. Twenty invited and volunteer papers on a variety of topics relating to natural resources policies formed a basis for formal and informal discussions among the participants. Through these discussions, a dynamic process of communication was begun which, hopefully, will be continued in future meetings.

The seminar emphasized policies that impact Biosphere Reserves, areas designated by MAB for long-term study by both natural scientists and social scientists in order to develop a basis for rational use and conservation of all that portion of the earth's crust and lower atmosphere which contains life. As part of the seminar, participants visited La Michilia and Mapimi Biosphere Reserves, both located in the State of Durango, to observe first hand the social and environmental consequences of natural resources policies imposed on these areas. Of particular interest were those parts of Mexico's Biosphere Reserves that are subject to manipulation by man. It is from these areas that people living on or adjacent to Biosphere Reserves commonly derive their livelihood.

The proceedings of this international seminar, including the 20 invited and volunteer papers and a summary of the visits to La Michilia and Mapimi Biosphere Reserves, will furnish a record of the event.

Peter F. Ffolliott
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USDA Forest Service
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G.R. Stairs[2]

OMNIA MUTANTUR NOS ET MUTAMUR IN ILLIS - ALL THINGS ARE CHANGING AND WE ARE CHANGING WITH THEM - a phrase that could well be our theme for this meeting and for the decades ahead. We live in a time, and look forward in our planning, to an era where wise resource policy decisions will play an increasingly important role in defining the human condition. The world, in years ahead, will be characterized largely by three forces:

1. the vital force of increasing population numbers;
2. growing per capita consumption adding a multiplier effect to the increased population numbers; and
3. new orders of mobility in terms of human resources as well as in knowledge and information systems.

In ecological terms, we are rapidly reaching the point where the ecological law of environmental resistance will prevail. That is to say, the more intense the exploitation, the more difficult to have each individual grow and reproduce.

Sociologists, economists, and political scientists talk today of a new international economic order. We have already moved from a buyer's market to a seller's market in terms of raw materials obtained from both renewable and nonrenewable natural resources. Distribution of the world's natural resources is unequal, and the reserves valued by man exist in both developed and developing nations. The political and economic power base obtainable from significant natural resources may be further enhanced by new cartels. Whether in the form of national or international associations, multinational enterprises or country-owned enterprises, these potential blocs may well dictate the major developmental boundaries for all nations.

The current world energy situation provides an example of things to come. Similar shortages, or price escalations may increasingly become common in the metals and minerals sector. We know, all too well, that food supplies are limited and that agricultural land and productivity bases must be increased. Wood, as a material, gains continually in world markets at a rate outstripping almost all other commodities or materials. In many parts of the world, the major source of domestic energy is wood; its availability is decreasing at an alarming rate.

Nations of the world are, at this time, meeting to conclude a 9th and final session on laws of the seas. The disparity of opinion that exists in these sessions represents an entry into the difficult questions related to multinational control of natural resources. Resources at the ocean floor are not yet well defined, nor are they technologically or economically available in many instances. Still, the speculation about their future ability to interact with land-based resources has created important and sensitive political issues. For example, the suggestion that a multinational corporation be formed that would have both policy and operational functions raises questions of financial and technological sharing. The developed world would be called upon to make concessions in this regard in favor of parity among all nations. While easily supported in an idealized sense, the proposal presents difficult questions about technological and financial support systems. The degree of complexity encountered in these negotiations raises concern about our collective abilities to resolve resource issues on an international basis where technology, ownership, and political territoriality are already deeply entrenched. Yet, as societies develop, the need for such international understanding and the development of a global-scale decision making infrastructure becomes increasingly a matter of necessity.

It is clear that social and environmental consequences of natural resource decisions at the national level may have significant impact on an international scale. Each country must begin its planning hierarchy with a global reference, and equally importantly, must be prepared to share the methodology and responsibility of decision making at international levels.

This meeting, organized to discuss the social and environmental consequences of natural resource policies, has acknowledged the interdependence among nations. It is appropriate that we dedicate a portion of our discussion to major international efforts to bring about better understanding and utilization of the world's resources. While

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[1] Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

[2] Professor and Director, Center for Resource and Environmental Policy Research, Duke University, Durham, North Carolina, USA.

programs, such as "Man and the Biosphere," are an important means for developing technical and scientific exchange, they also provide a forum to discuss policy issues. The latter is particularly important, for too often we concentrate our efforts at the microscale before a good understanding of the macroscale is reached. It is all too easy for decision makers to retreat into the security of disciplinary or localized concerns and thus overlook or avoid the consequences and interaction of broader policy issues.

While our intent is focused upon sharing information at the international level, we must find specific examples at the country level. Here, we again remind ourselves that policymaking requires an understanding and appreciation of the total planning process. More specifically, it is important to view natural resources policy as a subset of national planning, and for those examples studied at this session, as a part of rural development. Designation of national parks, biosphere reserves, prime agricultural land, productive forest and grazing lands or other land uses cannot escape interaction with social and political concerns. Demographic pressures, land tenure issues, economic versus environmental concerns, and other issues must be kept in mind as we move forward to refine our scientific bases. The intent to bring senior policy makers to this forum provides an opportunity to address the question of how well national planning can accord rural development and natural resources policy designation. Is there sufficient national interest at economic, social or political levels to allow accomplishment - or are we a small group, only addressing and reinforcing our own convictions as we look inwardly at the issues? How well defined is the articulation between senior policy makers at the national level, senior policy makers in the natural resources sector, and senior scientists or policy makers at the resources management level? The discussion of these items will be at least as important to the purpose of our meeting as are issues of ecological carrying capacity, genetic reserves, or preservation of plant and animal speciation. We must concentrate a major part of our attention upon insuring that the resource policy solutions we are capable of providing at specific levels are also given attention in generic national policy schemes.

Two primary concerns face the policy decision maker when addressing questions relative to specific resource areas or issues. The first is to accord the previously discussed matrix of broad issues, the second is to bring contemporary technical and scientific competency to bear upon more specific issues. The latter topic opens discussion on a complex and growing topic. Growth in research data, an exploding knowledge and communication industry, and recently developed, advanced computational techniques provide a set of tools seemingly more than adequate to our task. Yet, we recognize that we still have much to learn, and perhaps more importantly, many decisions to make in regard to what types of investigation or study is most important. New systematic techniques come to mind. From the well known Club of Rome Model: "Limits to Growth" to more focussed and accurate models of small ecosystems, we find examples relating quantitative and biological logic in an interpretive framework. The related opportunity to apply microeconomic evaluation to resource policy decision making has been less common, but is, nonetheless, important as an analytical concept. In most situations, there is also a dramatic need to develop time-series approaches to quantitative models so that verification of biological events are possible. To do otherwise continually delays the question of model or simulation validation, and prevents the utility of combining traditional and newly developed methodology. Additionally, there is need to develop policy that requires or encourages scale compatibility of data between studies and between sectors within study areas. Finally, there is important policy reason to consider the benefit/cost relations of resource policy decisions. But the idea of benefit/cost analysis, while not a new concept, introduces new questions for solution. How will we quantify nonmarket values? Are there real opportunities for Pareto optimalities among our policy alternatives? In welfare economics parlance, who will benefit and who will pay?

In summary, we recognize that increasing public concern for resource and environmental policy has characterized our respective nations for a period of two decades. These pressures raise questions of public control and have generally been responded to by pricing theory, by preachment (education), or by policy (regulation) authority. The dual concerns of societal betterment and just compensation are inherent policy issues, as one addresses natural resources issues. An absence of legally defined rights for land, air, or water places no private cost on environmental concerns therein related, but may carry a very heavy social cost. While the problems of resource and environmental issues may be relatable to market mechanisms, the definition of legal rights and policy must precede this action. In turn, it is necessary to base the efficiency of both upon the availability of information. And so we come full circle back to the purpose of our meeting to exchange information, to disucss policy, and to improve our individual ability to chart wise courses for the collective good of mankind.

Finally, we must consider a time table for action. I thought about defining or suggesting a time in the near future when we must begin major, increased effort devoted to wise resource policy development. A time beyond which we might not recover losses suffered, and might not regain the integrity of our ecosystems. In terms of moral obligations to human kind. ...I thought about what time to choose....and then I realized that we are already there.

Biosphere Reserves: A New Method of Nature Protection[1]

Gonzalo Halffter[2]

INTRODUCTION

The conservation of nature and of the gene pool, or the wealth of animals and plants, has passed in this century from being an establishment set up by scientists from an intuitive and mostly ethical base for the future to a practical necessity of national and world policy. Although many of our leaders are still unaware of it, a country that destroys its ecological equilibrium and its genetic heritage closes its options for the future just the same as a country that destroys its historical heritage. In the name of temporary and controversial development schemes, and sometimes because of ignorance and lack of initiative, these countries are increasing their dependence on the industrialized countries.

Departing from the aforementioned concepts, I would like to begin my presentation with two questions, two questions which form the true base of any policy of natural resource protection in countries like ours:

1. Is it worthwhile and possible for the intertropical developing countries of today to achieve their goals with any kind of park or reserve destined to protect ecosystems, plants, and animals that does not include the people of the area as part of its structure and function?

2. In these countries, is there moral, political, and economic justification for protecting areas from exploitation when the lack of food is a reality and production must be increased?

There is no single answer for either of these two disquieting questions. The answer depends upon the position of the interlocutor relative to the problem of plant and animal conservation in relation to development, the kind of nation he wishes to construct, the socioeconomic situation of the country, and the characteristics of the local ecology.

Why are intertropical developing countries singled out in this outline? Undoubtedly, the possibilities (and problems) of natural resource conservation are totally distinct in a developing country from those of an industrialized nation. Primarily, the high rate of population increase and the growing demand for solutions which accompany the economic development process generate strong pressures on those natural areas not yet densely habitated or exploited. The availability of resources and qualified personnel is also not the same. In addition, the intertropical ecologic considerations are very different from those of temperate or cold-temperate countries. The richness of tropical ecosystems masks the difficulty of rationally managing them for man. Their fragility has been pointed out many times.

Because of the above and for other reasons, such as the position of the average citizen in the legal system and the public opinion on natural resource conservation, the above-referenced questions are only truly significant in countries of the intertropical zone which are trying to create their future and have the opportunity to do so.

NATURAL RESOURCE CONSERVATION POLICIES

In Mexico, our national park system demonstrates a definite influence from the United States. We try to protect beautiful or interesting areas in which the only permissible activity is tourism. National parks in Mexico are quite varied; they range from those whose extent and composition no ecologist could criticize, to parks of only a few acres in size (true public gardens).

Undoubtedly, with the exception of the most recently created parks, preliminary studies have not been made. There has not even been an ecological basis for the selection of location and extent of parks. The interests and future development of local populations has never been taken into account. In addition, the system of land ownership is confused in most cases, and although the land may not belong to the state, it is regulated by the state.

The above situation is not exclusive to Mexico, which even now has a better system of national parks than most Latin American countries.

Inadequate methods of protecting the natural resources are not exclusive to developing countries. Many highly industrialized countries are also not very efficient, and their concept of nature protection has still not adapted to the new conditions of our era.

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[1]Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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The uncomfortable truth is that, with the exception of a small group of nations, the methods of natural resource protection vary between deficient and very deficient.

The formal presentation of a reserve as such is another matter. If all parks and reserves proposed and accepted, which are officially listed by international organizations, would function today even partially, the conservation of our plant and animal richness would be assured.

In the wealthy countries with large areas without strong demographic pressures, the traditional system of national parks can be efficient; many of their parks can be, besides recreational areas, true biological preserves. In those countries when it is desired to convert the principal parks (or forest or other type of reserves) into biosphere reserves, the change is only a formality. The basic structure is already in place and working. All there is to do is adapt new, broader objectives; the original activities of the park are not excluded. One example is in the United States, where the different park systems (national, state, etc.) created to protect areas of special natural beauty for public recreation (such as tourism, camping, hunting, or fishing) are very efficient units for the conservation of plants and animals. One characteristic of the national park system in the United States, which we cannot forget, is that the laws that regulate them relate to the idiosyncrasies and needs of the country. This is what causes the average citizen, including those that live in the areas around the parks, to obey the laws and understand that they are in his own interest.

The situation in many Latin American countries is different. Demographic pressures force many people without land (and without the opportunity for any other activity than subsistence agriculture) to illegally occupy protected zones. There is no real control over hunting and, in many cases, it is difficult to see how one could be established. Forests are cut, sometimes with the complicity of lower authorities. Tourism is not organized, the most visible result of which being the discarding of trash and the deterioration of the environment.

It is easy to blame these anomalies on the inefficiency of administrative organizations. There is some truth in this supposition, and there is much room for improvement with the current system. But, we need other methods of natural resource protection if we really wish to save a significant portion of our ecosystems and the biotic material in them. The system with the most possibilities is a parallel system of Biosphere Reserves.

Why is it that national parks are not sufficient to cover all the needs for resource protection in intertropical developing countries? There are several reasons:

1. Their establishment does not include the interests, the way of life, nor the future of local populations. When the interests of the population have been taken into account, the urban population is considered more often than the rural population. Often, the only gains left to the local rural population are those from tourism.

2. They do not include the search for new forms of development (which is closely related to the first point) or new avenues for more rational exploitation of biotic resources.

3. Research is proposed (when it is) as a secondary activity.

4. The training of high level human resources is not considered.

5. In a long-range national policy, it is not the same to preserve a pretty place as it is to conserve the gene pool (the wealth of animal and plant species) as an integral part of national and world heritage.

6. Ecologic criteria are seldom essential in the selection of areas for conversion into parks. Undoubtedly, the parks do not form a system of representative areas of distinct ecosystems integrated in a global context.

For intertropical developing countries, the solution for the establishment of national parks under the conditions and priorities of today is not to do away with the park (which would be a true step backwards in natural resource conservation), nor is it to transform all of them into Biosphere Reserves. The existing parks, correctly managed, can serve very useful purposes; one of them is to provide the population with the opportunity for solace and contact with nature, something which is becoming more difficult and necessary in the large urban areas. Besides, many of the parks contain areas of exceptional beauty which undoubtedly must be protected. And, if we can improve their administrative criteria (in which there are many differences between countries), the parks can contribute to the conservation of the gene pool.

As we understand it, the solution in countries like Mexico is to establish a system of Biosphere Reserves which is parallel and complementary to that of the national parks. In certain areas, this may involve joint efforts and protected areas, but in no way does it imply the abandonment of existing parks. Within the Biosphere Reserves, we include all those protected areas belonging to universities and research centers whose principal goal is the protection of the gene pool, scientific research, and teaching. The Universidad Nacional Autonoma de Mexico has two biologic research stations which are excellent examples of this type of establishment.

We have recently seen that the existence of two parallel and complementary systems of conserva-

tion forms part of the new national policy of natural resource development now being developed by Brazil. Apart from the existing national parks they are creating a network of "Ecological Reserves", very similar to Biosphere Reserves, which are even managed by a different governmental agency than the national parks. There are also some protected areas controlled by universities and research centers.

In Mexico, the need for this type of parallel development is not yet understood in certain sectors. The pressure to control the Biosphere Reserves as if they were national parks is great. This appears in legal documents, which involuntarily contradict years of effort by scientists (especially in the Institute of Ecology) by committing the error of designating as an "integral reserve" all of the area selected for a reserve in Montes Azules, Chiapas. This is not simply a semantic difference. We are trying to defend the conception and development of Biosphere Reserves within the limits that we have established, without trying to replace the system of national parks and, for all of the reasons already mentioned, without allowing them to be absorbed by the national park system nor legally implanted as similar to it.

In the politics of rational use of natural resources and the creation of a natural national heritage, the Biosphere Reserves (La Michilia and Mapimi) created by the Institute of Ecology with the support of the Government of the State of Durango, or created through a proposal (and background study) by the Institute itself, play a very important part. We will now make reference to some aspects of their development.

THE BIOSPHERE RESERVES OF MAPIMI AND LA MICHILIA

For the scientists, as well as the politicians that live in industrialized countries, it is difficult to attain an adequate understanding of the complex problem posed by the wise use and protection of natural resources in a developing nation like Mexico.

Within the context of natural resource protection, the basic premises and goals are universal. However, problems and pressures of every kind, especially social and economic ones, are completely different in a highly industrialized country than in a developing country. The former Governor of Durango, Dr. Hector Mayagoitia Dominguez, in his presentation at the central offices of UNESCO in June of 1979, pointed out that two aspects stand out in the web of factors and interactions present in countries like ours, between what is desired and what actually can be done, between what is planned and what is realized, two characteristics which form the common denominator of the complex problem: urgency and contradiction. In other words, the solutions must be worked out in a race against time and in a contradictory context.

In the developing countries of the intertropical zone, we must protect a rich and varied gene pool which represents more than 80 percent of the natural world heritage. Efficient conservation requires an adequate number and extent of reserves. But, it is in our countries that we have the greatest increases in a population which is still primarily rural; more people in need of more land.

Intertropical ecosystems are not easy to exploit. Their rich and diverse species composition, and the lack of technological development adequate for the exact needs of those ecosystems, make difficult the selection of efficient methods of exploitation which produce wealth and well-being while insuring the permanence of the resource. The impact of the market system on the destruction or disequilibrium of the traditional self-sufficient socioeconomic structure does not help either. On the contrary, it complicates matters. Economic pressure and proliferation of intermediaries increase the extensive and precipitate nature of the unplanned exploitation of natural resources, which keeps no reserves for the future.

It is within this panorama that we must develop, with all haste, efficient methods for protecting representative parts of our ecosystems, along with rational and planned use of our natural resources.

We have pointed out that the national park system is not adequate to protect representative sections of ecosystems. As of 1975, we have begun to search for other alternatives. The Institute of Ecology, as part of the activities of the National Council on Science and Technology (CONACYT and with the help of the Government of the State of Durango and the Secretariat of Public Education, began to work in the Mapimi and La Michilia Reserves.

In Durango, the development of Biosphere Reserves is based on four points:

1. The willing cooperation of ranchers and peasants.

2. Research and teaching of the highest quality.

3. The combination of basic research with development programs; and

4. International cooperation.

In the aforementioned UNESCO meeting, we pointed out that the fundamental objective of the Biosphere Reserves in Durango was the protection of the gene pool and a better life for man, without opposing the interests of the human populations of the area with those of the local plants and animals.

From the beginning, we have thought that the importance of Mapimi and La Michilia should not be judged only by the protection obtained in specific

areas and certain species in serious danger of extinction, or by the good works done in the fields of population dynamics and strategies, zoology, botany, and ecological development. Mapimi and La Michilia are an experiment in a new concept, an experiment carried out at the time when our country is in search of a new policy both for the protection and the exploitation of our natural resources.

Although this approach shares many of the concerns that initiated the creation of the first large national parks, there is an important change of attitude. That is, there is concern for the people that live within the zone of influence of the Biosphere Reserves, and the search for adequate uses of the natural resources. In the long run, this is the best protection for integral reserve areas dedicated to the conservation of the gene pool.

There is another important difference. Although derived from the philosophy of the Man and the Biosphere (MAB) of UNESCO, the Biosphere Reserves in Durango are not a copy of something made on the outside. They are our own experiment, set in our reality, realized according to our possibilities.

The Government of the State of Durango has bought the areas selected as integral reserves or core areas in which the only allowed activity is scientific investigation, and the object of which is the conservation and study of the fauna and flora. However, surrounding these integral "core" areas, of their own volition, private ranches and "ejidos" (common lands) have grouped. Ranchers and ejido participants have been educated as to the objectives of the Biosphere Reserves. Through much hard work and in many local meetings, the people have been introduced to and convinced of the objectives of the Biosphere Reserves. An important part of the work of the scientists has been, and still is, the explanation of the objectives of the reserves to the rural population to incorporate the people into their work.

The areas surrounding the core areas are under production and constitute the buffer and experimental areas which protect the core. In a voluntary but efficient manner in Mapimi, the hunting of the large desert tortoise (Gopherus flavomarginatus) has been stopped. This is a great effort in a poor area where the tortoise provided a source of meat. In cooperation with the ranchers in La Michilia, we are experimenting with the joint exploitation of deer and cattle. In both Biosphere Reserves, ranchers, ejido members, and scientists work together in search of better uses of the natural resources so that, instead of destroying them, preserve them and even regenerate those parts affected by incorrect use.

Intensive work is done on new alternatives which complement and diversify the traditional uses of the land. In the periphery of La Michilia, apiculture has passed from the experimental to the productive stage. In the same area, crops of high economic yield, such as strawberries (new to the region and requiring large amounts of physical labor) have been introduced. Agroindustries, such as the production of jam which provides better use of the local resources, have been successfully developed. Multiple use models are developed which provide rational use of game animals while optimizing the use of grazing lands and forests to increase cattle production.

Since the initiation of activities in Mapimi, a series of scientific works on population dynamics and ecologic strategies of various plant and animal species have been carried out. These works not only open a new field of investigation of Mexican ecology, but they have been a starting point of applied research of immediate utility (i.e., the increase in areas occupied by the grass Hilaria mutica, the base of the difficult desert cattle industry, or the improved conservation of water for cattle).

Undoubtedly, the development of the above works, in strict cooperation with the ranchers, has had an immense influence on their attitude toward the Biosphere Reserve. The ranchers and small farmers of the region feel that the Biosphere Reserve is their project, in which not only are scientific problems of interest to the researchers studied, but in which new solutions to their problems are also investigated. The result has been complete cooperation in the protection of the core areas, in research activities, and in efforts to protect species in danger of extinction, such as the great tortoise. All of this has been achieved through cooperation and mutual effort, never by police coercion. Cooperation has come to the point where the ranchers voluntarily dedicate part of the proceeds from every head of cattle they sell to the work at Mapimi.

The vigor within these relationships which allows researchers, students, farmers, ranchers, and the authorities to establish common purposes and to work together for their completion adds to the evolution of an already priceless Mexican social structure. We are convinced that if this policy is maintained and the resources protected, more researchers will continue the efforts for rational use of the resources. The Biosphere Reserves will then be assured of permanent and effective protection of the core areas. We must not lose sight of the influence that this new focus can have on relations between man and the environment on a regional and national level.

The Biosphere Reserves of La Michilia and Mapimi do not pretend to solve all the problems of protection and management of natural resources in Mexico, or even in the State of Durango. They do offer new alternatives for their conservation and use, with a solid base in scientific investigation. It is not utopia to think that new strategies of ecological development can arise from the Reserves. On the contrary, it is an objective, as important as the conservation of natural resources.

Impacts of Policies on Specific Renewable Natural Resources: Forest Resources[1]

G.R. Stairs[2]

Land use and natural resource policy must take care to address issues related to what society often calls marginal land. But the term "marginal land" requires definition. Society has long been willing to place high priority on prime agricultural lands and on high value urban or industrial lands. Similarly, we often give land use priority to transportation systems and communications networks. A relevant question to ask is, have the forests, grazing lands, wetlands, preserves, and other unique ecosystems been given similar attention in national resource policy setting? To the point of this paper, is marginal land a residual, excluding such areas as forest lands, or are forest lands to be derived from what the macro planner sees as marginal lands? Philosophically, it is policy relevant that a well-defined categorical identification of forest land be obtained; practically, it is absolutely important if we are to obtain appropriate societal valuation of these valuable lands.

At the global level, we have about 13 billion hectares of land: 4 billion are forests, 4 billion are grazing areas, 1.5 billion are agricultural, and the remainder (3.5 billion) are tundra, snow, ice, desert, or rocky areas. The world pressure to expand food production calls for expansion of the agricultural sector to about 3.2 billion hectares. Such a policy requires land use transfer from forest and grazing uses to intensive agriculture. A major proportion (1 billion hectares) will probably be obtained from the world's tropical forest regions. Alternatively, one could suggest that a policy of utilizing tree food crops could become a "middle ground" between traditional forest management and intensive agricultural cultivation.

In any event, it is clear that forest land will continue to be under pressure from new societal needs and land use policies, as well as from traditional forest uses. Historically, forest lands have primarily been exploited for wood as an energy source; cleared for agriculture, suffered depletion due to grazing impacts on vegetation and soil, or utilized for wood as a material. The amenity values of recreation and the value of watersheds and wildlife habitat have often been overlooked in serious planning or management. As a result of historic and current exploitation, the world's forest lands are badly managed and are being reduced in size at an alarming rate. At the current rate of depletion, the forest areas in developing countries (1,200 million hectares of mature forest) will be consumed in about 60 to 90 years. The current depletion rate, about 15 million hectares per year, will be further increased through agricultural expansion and increased consumption by the 200 million people who live within or near these forests.

Despite the obvious importance of the forest as a renewable resource for national economic and social stability, there has been little effective policy to reverse current trends. In the developing nations during the past two decades, investment by governments in the entire agricultural sector, (including forestry and grazing) has averaged only 12 percent of the total national development program, despite the fact that the gross national product contribution from this sector has averaged over 30 percent in these countries. The portion of investment by the agricultural sector in forest land restoration and management has been only a fraction of that devoted to food production and cash crops grown under intensive cultivation. A further paradox relative to past policy decisions may be seen in the rapid price escalation of wood as a material moving in international trade. In developing countries, export values for wood have risen from $1,500 million in 1970 to $3,000 million in 1975. Annual world production of forest products is over $115,000 million, while that portion moving in international trade is over $30,000 million. The trend seems well established, and it is highly likely that there will be even greater demand for wood as a material in the next decade. Wood products have steadily remained one of the most rapidly rising (in terms of price) trade items among all commodities.

Thus, we may view the forest land sector as threatened by growth, both in traditional exploitation areas and by increased efforts to expand agricultural and other land uses. These issues require more policy attention than they have received in most countries. The micro- and macro-economic consequences of land use policy should be quantified as part of overall natural resources policy analysis. Too often we attempt to introduce forest

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sector recommendations into national resources planning without an appropriate look at the welfare economics inherent in these situations. As alternative uses for land become more active, it is necessary to quantitatively define both market and nonmarket values and to provide qualitative, professional, moral, or ethical judgements. In particular, the forest sector must be included in broader rural development policy making as a part of comprehensive land use and natural resources planning.

Turning to policy issues within the forestry sector per se, we may usefully segregate our concerns into environmental or ecological issues; and commercial aspects, with consideration for both domestic and foreign trade. Both major sectors may be further analyzed in relation to subsistence and local needs, as well as in reference to future national resources planning. It is important to develop a policy that will bring the forest resource sector beyond subsistence levels and into prominence as a major renewable natural resource.

The success of political and societal decisions in the future will rest heavily upon the natural resources base. It would seem increasingly obvious that political and policy deficiences of the past cannot continue in the decade of the 80's. An African leader, Zaire President Mobutu Sese Seke spoke recently about the importance of food: "In the coming years the wealth of a country will no longer be evaluated in terms of diamonds, nor of gold, nor of copper--but rather the capacity of each government to know how to feed its people." His statements could as easily, and perhaps more precisely be broadened to include the renewable natural resources base and our ability to provide quality-of-life materials such as those values available from our forest lands.

Policy dimensions related to environmental concerns must first address resource conservation and utilization issues. Local demands for fuelwood, grazing, and wood as a material cannot be sustained in perpetuity under conditions that currently prevail in most areas. Policy alternatives may be varied relative to the mix of goods and services to be obtained from a given land unit, but there cannot be tolerance for terms that would allow either short or long-term site degradation. Devastating past practices must be corrected through major intervention programs. The societal values to be placed upon the forest reserves increases steadily and a policy for narrowing the gap between the resource value and the national input to forest restoration and management must be closed. While policies should be developed to allow decentralized, local inputs, it is unlikely that local areas will be able to correct past practices without central government support.

Defining environmental or ecological policy in terms of recreational use, preservation, conservation, or other amenity value is relatively easy in the qualitative sense, less so in quantitative or econometric terms. Nevertheless, it is vitally important to adopt natural resources policies that require economic analysis for both market and nonmarket forest values. Soil erosion problems, lowered water yields or quality, and the overwhelming impact of encroachment and shifting agriculture are items that must be assigned real value in terms of social and monetary costs. In addition, the cost of regaining or delaying corrective action must be defined. While estimates of input and output values should be derived from willingness to pay evaluations, we know these benefits and costs typically may extend over hundreds of years and thus economic discount rates, as well as social valuation, must be used. Selecting a discount rate and determining willingness to pay are topics appropriate to advanced economic study. Sufficient to our purpose in this discussion is the call for sound economic analysis as a prelude to final policy decision making.

I have suggested herein that a heirarchy of policy needs must first recognize the need for conservation and restoration of the forest resource. A second stage will be to select a management policy that will provide the mix of goods and services desired and to allow for deviation only under carefully monitored conditions (fig. 1). A third state relates to the need for domesitc consumption and for local use or export and industrial production. Provision for local use will usually take priority, in most regions from lands nearest settlements. Policy selection may favor subsidized use of forests at the local level as a more effective solution than alternative economic or development programs. The use of wood for energy in direct combustion, alcohol production, or charcoal provide examples.

The potential for wood as a material in trade increases daily. National needs for low-cost housing suggest the potential for articulated systems integrated from forest to urban housing schemes. The pulp and paper industry will continue to rank well in progressive economies. Tree food crops may become locally important in many regions. As these industrial programs develop, policy issues relating management costs for restoration and productive use of forest land must also account for the social and economic values therein. There is opportunity to develop labor-intensive programs and to stimulate rural development. Secondary manufacturing at appropriate scale in wood products may help to stabilize local economies and seasonal labor forces. The opportunity for training workers can be taken with a view not only to forest operations but also to related construction trades. Finally, the externalities of forest development must receive careful policy attention. Development of a commerical sector may have impact on other welfare or profit systems in the nation. Within the forest sector, trade-offs exist between various uses such as timber production, watersheds, and grazing. These induced effects within the commercial system must become part of a benefit-cost policy analysis.

Thus far in this presentation, discussion has focused on policy related to restoration, conservation, and then utilization of forest resources.

Figure 1.--An example of a Southwestern forest managed for a mix of goods and services, including timber harvesting, grazing, and wildlife habitat (U.S. Photo Service photo).

There remains a need to further define policy for forest reserves. These areas are maintained in association with managed lands but are protected against the loss of their natural character. Even here, policy alternatives may range from completely protected natural systems to partial utilization, either in space or time. For example, it is possible to think of "recycled" wilderness even though this goes against our normal definition of a reserve or natural area. Reclaiming lands for preserves falls in this category, as would a policy for maintaining reserves on a cyclic basis over long periods of time. For example, reserves may be moved into and out of recreational use, light commercial harvest, watershed protection, or grazing dependent upon carefully defined management practice. In this method, we would be opting for a much less rigid definition of reserves or preserves, and would be defining a graduated series of land classification rather than a system with abrupt discontinuities.

The policy alternative for forest reserve establishment represents the most critical of our decision set. While policies must recognize a continuum of land use classification, there must be reserved a special category for these lands. It is here that we find it most difficult to regain the natural status desired and to maintain it against encroachment. It is also on the reserve lands that a great deal of our future forest ecosystem research will be conducted. Maintaining reserves of natural diversity, study of competition and site requirements, and related biological or physical relations have meaning beyond the naturalists' interest. As more intensive land use practices become increasingly commonplace, it is vital that representative natural areas be maintained as insurance against man's mistakes. The Man and the Biosphere (MAB) program provides an operating research policy to reinforce this concept and it is vital to international cooperation and coordination. In particular, the MAB program allows exchange of scientific and technical information at sessions such as this one where policy-level considerations can be discussed.

In closing, I suggest to you that the concepts of this session should be seen as an open door to future interaction among our countries and institutions. Yet, we also need to be cognizant of other bilateral and multilateral efforts and to also relate our work to these existing organizations. It is a common practice to start new committees or organizations at each major meeting, and that may not always be the most efficient means for obtaining coordination. Nevertheless, I feel this meeting, with its focus on policy issues, provides a theme that is worthy of continuing. I hope and trust that we can continue to build upon this start toward a future of better understanding and information exchange for forest and related natural resource policy issues.

The Impact of Natural Resource Management Policies on Forest Resources[1]

Jose Trueba Davalos[2]

INTRODUCTION

The social and environmental consequences of natural resource management policies with special emphasis on forest resources, which is the focus of this seminar, have been, frankly, noxious. This is because of the impact of management policies on the forest resources. However, to proceed in an orderly manner, it is indispensible to set forth a frame of reference with which to begin the analysis of the problem.

A FRAME OF REFERENCE RELATIVE TO THE PROBLEM OF FORESTRY IN MEXICO

The forested surface of Mexico is composed of those areas covered by trees, chaparral, brush, grasses and forbs. It covers a total of 137.2 million hectares, or about 69.8 percent of the country. This vegetative cover is natural and develops in those zones whose topographic constitution have permitted its spontaneous development.

The Forest Inventory Classification divides the forested area into wooded areas and other forested areas. The wooded areas extend over 44.2 million hectares (22.5 percent of the national area); the "other" forested areas contain 93 million hectares (47.3 percent).

Wooded areas are those forested areas in which well-defined communities of trees predominate, and which have a certain density level; these areas are divided into forests and jungles.

The forested area currently occupies 29.2 million hectares (14.9 percent). Forested areas are divided into coniferous-hardwood forests, which extend over 20.6 million hectares (10.5 percent) and hardwood forests, which cover 8.6 million hectares (4.4 percent).

Jungles comprise 15 million hectares, or 7.6 percent of the national area. They are classified into high jungles (2.4 million hectares or 1.2 percent) and middle jungles (12.6 million hectares or 6.4 percent).

There are two other forest classifications: Disturbed areas (16.4 million hectares, or 8.3 percent of the country) and aquatic vegetation (1.1 million hectares or 0.6 percent).

Of the 137.2 million hectares which constitute the forested area of the country, only 44.2 million (22.5 percent) are considered wooded areas and are, therefore, productive lumber areas for different uses.

In seven states of the Republic, 67 percent of the 29.2 million hectares of temperate or cold forests are concentrated. They are Chihuahua, Durango, Jalisco, Michoacan, Guerrero, Oaxaca, and Chiapas. In another six states (Veracruz, Campeche, Chiapas, Yucatan, Oaxaca, and Quintana Roo), 80 percent of the 15 million hectares of hot-humid forests are found.

The estimated reserves of economically usable log timber and their productive potential for 1975 are summarized in Table 1.

Table 1. Economically Usable Forest Reserves in 1975[3].

	Area (Ha) (Millions)	Existing Volume m^3 (Millions)	Annual Potential m^3 (Millions)
Conifers	14.7	1,250	21.6
Leafy trees	14.8	550	7.6
Total	29.5	1,800	29.2

Although these data are for 1975, they can be considered generally valid through 1980.

The participation of the forest sector in the Gross National Product is very low, and in the last 18 years has shown less dynamism than has been shown in almost all the other sectors of the national economy (Table 2).

It is estimated that by 1977, approximately two million people participated directly as owners

[1] Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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[3] Castillo Fragoso, Ruben "El Presupuesto de la Federacion en el Sector Forestal." In The Periodical "Mexico y sus Bosques," Volume XVII. April, May, June of 1978. No. 2, Page 4.

Table 2. Participation of the Forestry Sector in the Gross National Product between 1960 and 1978.

Year	GNP	% Increase	Forest GNP	% Increase[4]	Participation In the Total GNP %
1960	150.5	-	0.882	-	0.6
1965	212.3	7.2	0.935	1.2	0.4
1970	296.6	6.8	1.149	4.4	0.4
1975	340.3	5.8	1.337	3.2	0.3
1978	432.3	3.5	1.477	3.4	0.4

of the forest, and by the year 2,000, this population will increase to 3.5 million. However, the population now living in wooded zones, approaching ten million inhabitants, could increase to 16 million in the year 2,000.[5]

The forested area is distributed into approximately 500 landed common areas or "ejidos," 100 communities, and 180,000 private parcels. These data, according to the information source, are approximate, due to the lack of accurate information on the subject. The area under organized production is reduced to that represented by 600 ejidos, 12 communities, and 1,300 private parcels. The rest is considered as potential area but, at present, unorganized or under marginal forest production.

Of the 7.6 million cubic meters of log timber produced in 1978, private companies produced 4.7 million cubic meters, state-owned companies produced 0.9 million cubic meters, decentralized organizations produced 0.8 million cubic meters, the ejidos produced 1.2 million, and the unorganized sector, of which a productive potential of 6 million cubic meters annually is considered, produced 0. It is estimated that the entire annual productive potential is 22 million cubic meters, instead of 7.6 million cubic meters now being produced. The National Forestry Plan has established the goal of 11.2 million cubic meters by 1982.

The organized and productive forestry sector is represented by 600 ejidos and 12 communities, as has already been said, of which 47 percent are yielding a return, and by 1,300 private parcels, of which 85 percent are yielding a return. There are 780 productive organizations.

As can be seen, private companies generated 73 percent of the forest production in 1976, and state companies (federal and state) produced 10 percent (Table 3). The ejidos produced only 17 percent.

[4]Average annual rate in the period. Source: Bank of Mexico.

[5]The data presented on this page are from the Annual Report of "La Direccion General para el Desarrollo Forestal 1978" S.A.R.H. Subsecretaria Forestal y de la Fauna. Mexico 1978 page I-35.

Although the data compared between 1970 and 1976 indicate a reductive tendency in the private companies, which dropped in production from 81 percent to 73 percent of the national total, production is still practically three times the state and ejido production, which together is only 27 percent.

But given the nature of the companies, instead of grouping the state companies with the ejido companies, the state companies should be grouped with the private companies which, together, manage 83 percent of the forestry production compared to 17 percent managed by the ejidos.

Within some of the ejidos, the administration (or, in other words, the participation of the ejido members) is organized exactly the same as in the capitalist companies. A very small "cutting license" is paid for the extraction of wood; later, the small profits or losses are divided. This is interpreted by a critical ejido member as resulting from a bureaucratized, unproductive, and even corrupt administration that hides and manipulates information and administrative participation to filch the profits from the members.

Whether or not these critical observations in relation to the ejido-run companies are true, in many cases the administration is run by a group of technical bureaucrats and the participation of the ejido is reduced, in the best cases, to a small cohort of leaders whose honesty is also frequently questioned by the ejido base.

A COMPREHENSIVE LOOK

What inferences can be drawn from the summary of data?

1. The forested surface of Mexico is immense, almost 70 percent of the entire national area.
2. Its contribution to the Gross National Product is negligible, less than 1 percent.
3. The data is explained, in part, because the wooded forested area only represents 22.5 percent of the national area, and the conifers and hardwoods, which are the most productive economically speaking, only comprise 14.9 percent. Although in this light, matters appear to change, it is impossible not to reflect upon the modest economic productivity of the wooded zones and the insignificant productivity of the nonwooded forested area, which represents 47.3 percent of the national area and whose components, altogether, cover 93 million hectares.
4. The consequence of this low productivity is that Mexico has to apportion 5 billion pesos annually to buy forest products, especially celluloides, from other countries.

However, the problem is not that serious. In fact, with a new forest production plan, we hope to gain self-sufficiency by producing a little more than 11 million cubic meters of log wood by 1982.

Table 3. Forms of Organization for Production or Industrialization (1970-1976).

	NUMBER		NATIONAL PRODUCTION		PERCENT[6]	
	1970	1976	1970%	1976%	1970	1976
Private companies with ordinary licenses	more than 200	more than 150	67	67	40	40
Private companies with industrial units of forest exploitation	10	6	19	86	22	62
State companies with forest exploitation units	3	3	5	91	11	73
Decentralized federal organizations	1	3	-	--	5	78
Decentralized state organizations	2	5	2	93	5	83
Ejido companies	±30	±130	7	100	17	100

A true statement of the problem is that the important costs are ecological and social. However, it is difficult for a society stuck in the one-dimensionality of economics to understand that ecological and social costs exist.

Lets try from another perspective to understand the forestry problems of Mexico. Natural resources have, historically, constituted a kind of natural infrastructure by which the small settlements of old satisfied their needs. These primitive settlements lived in symbiosis with their ecosystems, and generally, attributed to them the birth of the human race, and rendered unto them some kind of homage. The study of primitive cultures now living in little-known regions has verified this historical hypothesis.

During many thousands of years, man survived by hunting and gathering, which were frequently practiced in forest or jungle ecosystems. In this early period of history, man practically formed part of the ecosystem, to which he adapted without being able to significantly alter it. The objectives of this kind of society were quite simple, very related to their own subsistence, and probably with much available free time.

However, as economic, social, political, and cultural changes took place, and as society began a process of becoming more complex, the attitude of man toward nature began to change. It has been almost a historical constant for a long time, and still is in most of the world, that ecosystems were destroyed as the great civilizations and important cities of classic antiquity developed. There are historical testimonies of many forests destroyed near large metropolises.

"The deterioration of the environment," affirms David Dickson, "has always been related to social and economic development." Long before the birth of Christ, enormous forests of the Near East were reduced to areas without vegetation due to agricultural activities and to their loss of protection from the wind. This, along with centuries of intensive grazing, turned said forests into arid deserts.[7]

In his celebrated literary work, Plato also mentions this process in reference to Greece: "The soil continually sloughed off the mountains...sliding without stopping until disappearing into the sea... what now remains, in comparison with what was once there, is like the skeleton of a sick man; all of the soft and fertile land has been consumed, only the naked frame of the earth remains...what now are mountains were once high hills covered with soil; the rocky plains of today were replete with rich soils, and the mountains were populated with dense forests, of which some traces still remain. There are mountains in Atica that today can support no more than bees, but which, not long ago, were covered with beautiful trees, now appropriated for the roofs of the major buildings, there are still some roofs made from their wood... The country produced unlimited grass for cattle.

"The annual rains were not lost as they are now by running to the sea over the naked ground. Instead,

[6] Data approximate. Source: Office Report of the Direccion para el Desarollo Forestal 1978.

[7] Dickson, David. "Technologia Alternativa" Editorial--Blume Madrid 1978. Page 3.

in all their abundance, they were received into the breast of the country where they were kept in her impermeable clays until she evacuated the excess from the heights to the valleys in the form of deep rivers and springs, abundant over large areas. The Temples still standing in places where water once flowed demonstrate the truth of my hypothesis."

This classic text could be applied to many countries and regions, and in several ways is reproduced in the studies of this problem in Mexico.

"Today," affirmed Hans Lenz in 1948, referring to the forestry problems of Mexico, "the pitiless axe, driven by the poverty of the Indian, by the thirst for profit in some people or the ignorance of others, and forest fires devastate thousands of hectares, converting areas of rich vegetation into tracts of naked land, impoverished by erosion and useless for cultivation...where the hand of man has sacrificed majestic trees, useless weeds and sickly bushes are born; if the hillsides are affected, the springs dry up, the forest soil disappears through erosion...entire regions that were once privileged by their vitality, become deserts."[8]

In the same vein, the Forest Engineer Rigoberto Vasquez writes: "Agriculture, cattle, and forests constitute the foundation of survival of the people, and are based on productive soils."

"The soil as medium and water as the vehicle form the unit of production, but the determining factor in the functional equilibrium of them is integrated by a third element, which is the forest vegetation. The three form an indisputable triad which contains the key to human life."

"In order of dependence, agriculture and cattle are subject to forest vegetation, because the soil, hydrologic and climatic regimes, along with the condition of the soils depend upon the condition in which the vegetation in the high regions and watersheds of the mountains is in. It is necessary to understand that runoff waters and erosion control do not end with the construction of irrigation dams, nor with the cultivation of the flatlands, but on the slopes of the mountains, where the protective action of the forests, and only the forests, can combat the destructive force of the aquifers, erosive winds and floods."[9]

This perspective, which considers not the wood and not even the forest, but the ecosystem, as the true natural resource, constitutes the correct dimension in which the true value of the forest resource must be appreciated as an essential component of its own forest ecosystem. Not only that, but the forest ecosystem must be considered an element of a wider ecology. Even the so-called artificial ecosystems, as certain compact and homogenous zones of agricultural activity, and even the cities themselves (urban ecosystems, as they have been called), depend upon the forests.

It is in this ecological perspective that the forest acquired its relevance. The economic input of forest products (less than 1 percent of the Gross National Product of Mexico, although still with some importance) does not constitute the parameter by which the value of the forests should be measured, not even in other countries where their input into the GNP may be more considerable.

The significance of the forest achieves its true dimension when visualized as protector of the soil, conserver of water, reproducer of organic material, oxygenator of the soil, processor of solar energy, not to mention more of its biologic functions.

Wood constitutes no more than one of the secondary products of the forest. This does not mean that wood should not be exploited, or that its productive potential should not be increased, but that it should be considered in its true perspective as a subproduct, in a context in which the true value of the forest is its quality of conditioner of life and fertility.

This is how the forest was perceived, with a deeper ecologic conscience, by the primitive peoples whose lives depended upon the functioning of the ecosystem, which has been verified through studies of societies which still maintain certain sociocultural traits similar to those of primitive societies.

The difference between these two concepts--the forest as an ecosystem or as a resource--is intimately related to the two kinds of societies, the primitive and the modern. The latter is organized through a state with a large population subdivided into many sectors which occupy diverse economic activities, many of which live and work in the city and are very disassociated from the forests and ecosystems, of which they are frequently ignorant or are poorly conscious of the vital function played by them in the whole of society.

This modern society is organized under the euphemism that "business is business," for which wood has an exclusively economic meaning in monetary terms. This society, which is oriented toward producing massively for the demand of a gigantic market, voraciously consumes all kinds of raw materials and is structured under the name of gigantic international companies which assume the prerogative of defining the decision-making hierarchy of values. Modern society establishes what has become the prototype of the role played by these companies in the national context, the maxim that "what is good for General Motors is good for the United States." These companies are, because of the set of values they establish, a utilitarian ideological reductionism, very far from being capable of correctly

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[8] Lenz, Hans and Wagner, Helmuth. "El Bosque y la Conservacion del Suelo" Editorial Cultura. Mexico 1948. pp. 14-15.

[9] Vasquez de la Parra, Rigoberto, "Obras de Restauracion al valle de Mexico y de Proteccion a la Ciudad."

appreciating the ecological costs of the destruction of a forest or the social costs of appropriation of a raw material. Survival depends more on maintenance than on exploitation of the great community (ecosystem) of the which they use only part. They understand that their objectives are limited by the cyclic nature of biologic structure and the necessity of maintaining it.

It is worth pointing out that the Maring (name for the members of one of these primitive contemporary tribes) and other inhabitants of New Guinea concieve the world as a collection of cyclic processes. Not only are there orchards and forests (in their opinion simply different phases of the same cycle), there are also growth and decomposition of the oldest plants. The Maring call the spirits that care for the fertility of the orchards, pigs, and man, Rauua Tukup, which means "spirits of decomposition." These spirits are responsible not only for fertility, but also for death.

I suggest that ecological cycles, evident to the Maring, are hidden to the people of an industrial society because of the mere dimensions and complexity of such a society. For this reason, ecological considerations influence less and less in the objectives of society, for the simple reason that the ecological conscience decreases more and more, even where there is a certain understanding of ecological processes. (The economic interests of the human group interested in the direct benefits derived from the exploitation or use of the resource takes its place, to the detriment of the general or public interest of society.)

What is the value of photosynthesis in monetary terms? Of the development of organic material? Of the decomposition of organic material in the soil? Of a spring 30 kilometers from the forest? Or the price paid by the fact that 65 percent of the Mexican rural youth are being expelled from the rural environment to go work in the city?

In a company with a capitalist mentality (be it North American or Mexican, automobile producing or forest oriented), short-term gains are the only concern; ecological and social costs are simply ignored or transferred or, in the best of cases, evaluated with the same monetaristic logic.

These councils of stockholders from the world decision-making centers, from the capitals of the Third World countries, or from the Directive Council of some forest company under the pressure of the large institutions mentioned above, proceed as if there were no other criteria for decision making than those of their own immediate and monetary logic.

Whole countries are converted into sugar cane fields or coconut groves. Within the most unstable ecological systems on earth are found fields dedicated to the monoculture of "miracle strains" which can only mature if given huge quantities of fertilizers, herbicides, or insecticides which frequently must be imported over long and unreliable routes.

"It seems as though species diversity is also suffering as a result of commercial exploitation. Logging or wood-related industries tend to favor plantations of a single species of the same age group, which is the closest that silviculture can come to agriculture, with all of its problems and defects."[10]

This critical analysis does not pretend to advocate the suspension of the economic use of the forest, nor a return to the system of primitive societies. This analysis advocates that economic simplism be abandoned and ecologic and social criteria be established, similar, for example, to those proposed in the Eighth World Forestry Conference held in Jakarta, Indonesia, celebrated in late 1978, which sets forth in its Final Declaration a series of conclusions and recommendations which, although proposed on a world level, are essentially valid for Mexico.

There now exists all over the world a tendency to reduce forested areas, along with the growth of the population that lives in the forest and of the forest. This fact is alarming if you consider that in every region of the globe there is a close relationship between the existence of forest ecosystems and the availability of water and, in particular, the fertility and capacity of the earth to produce food for a deprived human population which annually increases by seventy million people.[11]

The forests of the world still cover a large area; their biomass is by far the greatest of all types of vegetation. However, urgent and efficient methods are needed to contain their destruction, which is pressured by millions of people that depend upon forest resources in order to survive and to better their living conditions, and who frequently advocate the change in use of the soil and the transformation of forested areas into agricultural or cattle-producing areas.

> "...if the current trends continue and the potential demand materializes, the possibility exists that there will be a great difference between the world need for forest products and the capacity of the forests of the world to provide them...this differential can only be avoided by stopping the decrease in

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[10] Rappaport, Ray A. El hombre et los bosques, edicion mimeografica, pp. 22-26.

[11] In Mexico the population increases slightly more than 2 million people annually. In contrast, the forested surface decreases by an estimated 200,000 hectares annually, according to the ex-subsecretary of the Engineering Branch; Cuauchtemoc Cardenas in NOTISARH No. 4, April 1979.

forest area and managing the forests as they should be, by cutting more, by achieving a more complete and efficient use of all the products obtained from the forest, by creating and intensively managing prosperous and extensive plantations, and lastly, by ensuring that the benefits of forest utilization get to the communities that own them, live in them or work in them..." (Paragraph 24 of the Declaration of Jakarta Eighth World Forestry Congress.)

The forest plays an important, altogether indirect role in the production of food, through the regulation of waters, erosion control, as a supplemental source of forage in times of drought, in addition to generating employment and producing wood and other forest products. However, an indirect function in the production of food is not enough; it is necessary, in many cases, to create a wider concept of multifunctional forest activity which embodies more direct production of food, such as wildlife.

In the last decades, droughts, floods, and deserts have increased. This tendency will increase if governments do not proceed with a good management program including reforestation. The droughts and accellerated desertification in Africa, Asia, and Latin America have caused loss of life, along with the misery of millions of people.

The growing scarcity of firewood caused by population pressure, along with the reduction of the forests and the increase in energy prices, has produced an "energy crisis for the poor" which has come to affect 1,500,000 human beings, lowering their already low quality of life. The burning of vegetative residue and dung translates into a loss of fertility and consequently a negative effect on the production of food.

According to the 1970 Census data, 21,252,909 Mexicans still used firewood or charcoal as their basic fuel. It is also estimated that the minimum consumption of firewood for a rural family is 10 kilograms per day, or 3600 kilograms per year. For 21.25 million Mexicans (4 million families) the consumption of firewood and charcoal is 12.4 million tons annually. It is desirable that forestry programs assign a high priority to the production of firewood in appropriate places associated with agriculture and with complete cooperation of the rural populations.

For these same reasons, it is very important to optimize the use of forest residues from logging as well as forest industries. In this context, forests acquire additional importance as alternative sources of energy.

Especially critical is the situation in the tropical jungles of the world which are reduced constantly in quantity and quality. Increased cutting of the best wood for exportation has created a damaged and poor quality forest, which has created serious human and ecologic problems, such as cut-and-burn agriculture in tropical zones. This has caused the large-scale destruction of forested and agricultural lands. This constitutes an urgent need for the restoration of productivity in these deforested areas.[12]

In the face of so many and such severe problems, we need to begin a global policy of forest management, a reorganization of the industry, the application of new technologies for utilizing the thin branches that are now lost, and the utilization of other species which are now not used or are underused.

The utilization of the forest resource should have as an objective an increase in welfare, particularly of the communities that live or work in the forest, and in general of the entire population of the countries possessing the resource.

In spite of the fact that the large forest companies are fundamentally capital-intensive, forest activity is generally labor intensive, as small industries usually are. Although it might be important to mechanize a few activities, the important role that forests can play as generators of employment seems to indicate that it would be convenient to deliberately conserve, at least in the short run, the labor intensive quality of forest activity. More modern and sophisticated technologies could be justified in the future if the utilization of the forest resource accelerates rural development.

The function that certain manufactured forest products, other than wood, can have on the generation of employment and the betterment of the quality of life is of fundamental importance.

We must promote human resource development programs oriented toward the utilization of the forest and, in doing so, increase employment opportunities for women in forest activities.

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[12] The National Clearing Program, which has operated officially in Mexico with Government backing isnce 1972, has cleared 114,000 hectares for agriculture and 423,000 hectares for tropical cattle production, having burned and destroyed 26.8 million cubic meters of wood in the five years of activity of the program. This is almost as much as the 28 million cubic meters reported as the usable wood production of the country in the same period (Magazine: "Mexico y sus Bosques," April, May, June #2, Page 5. Article by Ruben Castillo Fragoso). To this must be added the average of 5,000 forest fires annually in the country, according to data provided by the Department of Forest Fires of SAFH, and the 8 million cubic meters of wood which is extracted clandestinely, most of which is destined for use as firewood or charcoal. Additionally, overgrazing and agriculture also constantly affect the forested area of the country, constituting, together with the other factors already mentioned, a constant reduction of the national forested area.

The development of scientific forest research, the interchange of information, the development of technologies, and more scientific-technologic aid on the part of developed countries to underdeveloped countries is recommended.

Up to here, the ideas are from the "Declaration of Jakarta." This general perspective of what signifies the forestry problems of the world, and which is, although with regional variations, also applicable to Mexico, formulates the characterization of the national problem in the field.

THE IMPACTS OF NATURAL RESOURCE MANAGEMENT POLICIES ON THE NATIONAL ECOLOGY

The politics of this field have produced a growing conflict between the rural population inhabiting forested areas and the concessionary companies of forest utilization. Because they cannot directly take advantage of their resources and receive only meager cutting rights, the people adopt an attitude against the forest use of the soil. Since this use is lost to the people by being dedicated to agricultural or cattle-producing uses, the owners or legal owners of the lands try to recuperate for themselves the productivity of the lands they own. This has generated a growing hostility which extends from the extreme cases of intentional burnings to passive resistance through indifference or irresponsibility for what occurs in the forest.

On the other hand, and as an answer to the agricultural crisis throughout the country, there is talk of "widening the agricultural frontier." Generally, this expansion is planned at the cost of the tropical jungles, already punished too far by the expansion of grazing lands and by the slash and-burn agriculture of the rural people. What is new is that this step is being determined from the planning centers which have not considered that, although the million hectares that they will subtract from the forested area might represent a short-term increase in production, in the long run, it will have negative repurcussion because of the deterioration it imparts to the ecology.

The statistics on the ecological deterioration of the country are truly alarming. According to the data of the General Directorate of Soil and Water Conservation, the totally eroded area of Mexico was close to 30,728,000 hectares in 1978, and represented 14.99 percent of the national area. The area in an advanced stage of erosion covered 52,173,000 hectares (26.16 percent). The area of moderate erosion covered 46,742,000 hectares (23.96 percent. Only 34.89 percent of the country (66,746,000 hectares) was free of erosion or suffered from only moderate erosion.

We are speaking, without the benefit of rigorous studies, of the desertification of 100,000 to 200,000 hectares of land a year. Desertification occurs, not only in the arid zones, but throughout the country in areas of moderate and even good climate. Hillside agriculture, seconded by overgrazing, has been completing the work begun by deforestation.

The forest problem is also inscribed in the context of the two great differences which polarize day by day the conflict established within the framework of agricultural production, and around the two alternatives, the capitalist model, and the rural model.

Without a doubt, the forestry section has opted for the capitalist model, opting for short-run profits, and sacrificing those of the long-term and, of course, imposing high social and ecological costs whose impact is much stronger in the capitalist model than in the rural. This trend will be difficult to correct given the interests involved: bureaucratic corruption and the general lack of an ecological conscience.

We are of the hypothesis that the trend can only be corrected by promoting a rural model, in which it is the inhabitants of the forest that benefit from the forest rpoducts they are now denied. Only a popular rural movement, revindicating its right to forest products and organized for forest production, can force a change in the current policies in this field.

Ecological Planning in Land Use[1]

Arturo Gomez-Pompa
Silvio Olivieri Barra[2]

One of the most important conflicts that arises between political decision makers and ecologists is the inadequate utilization of ecologic criteria in the assignment of priorities for soil and resource use in the different geographic regions of our country. It is a common occurrence that forest or agricultural soils are dedicated to grassland, rangeland soils are dedicated to agriculture, and agricultural soils are dedicated to urban use. Criticisms of the deficiencies in the assignment of different uses to various types of soils have come from several sources and are frequently conflicting. The "vocation" of soils is talked about insistently with little idea of what this concept actually means. Superimposed on all of these discrepancies are the opinions of ecologists, biologists, and conservationists who demand the creation of national parks and biological or ecological reserves. This group presents its own criteria for the possible selection of uses for the land and its resources.

Faced with this conflict of opinion, the state and federal governments have opted to not plan at all and to allow the different groups to continue in their course. Eventually, the force of the most economically or politically powerful, the personal opinion of the governors or local decision makers, or the force of public opinion orients government in one direction or another. Sometimes, it is not even possible to ascertain what variables were or were not taken into account in a given decision. Given the results of this policy, which have not been good, the Federal Government decided to organize all existing information necessary to obtain a more solid foundation on which to base land-use planning decisions.

As a means of obtaining this information, several governmental agencies were created. The Commission of National Territorial Studies (Comision de Estudios del Territorio Nacional, CETENAL) took up the task of mapping the lands of Mexico ten years ago, and produced a very important series of climate, geology, topography, and soil-use maps. A parallel activity, perhaps motivated by other reasons but which ran in the same direction, was the creation of the National Commission for the Determination of Grazing Use Coefficients (Comision Nacional para la Determinacion de los Coeficientes de Agostadero de la Republica Mexicana) for evaluating the potential grazing lands of the country and determining the minimum area necessary for the support of one head of cattle. A further action was the creation of a National Forest Inventory, which also had the objective of mapping the forest resources of Mexico. The creation of the Directorate of the Synoptic Agricultural Map (Direccion de la Carta Sinoptica Agricola),a dependant of the Secretary of Agriculture and Cattle Production, and formerly of the Secretary of Agriculture and Hydraulic Resources, also took upon itself a cartographic study of the different geographic zones of the country producing the regional soil maps that complement the work done by CETENAL, now known as DGGTENAL (Direccion General de Geografia del Territorio Nacional). Other activities in the same direction, perhaps less well known, have been the work on soil fertility assessment, the agricultural, cattle, and forest censuses, and the mapping work done by state governments, universities, or ecological research centers of the country.

All of these activities indicate that there was concern to obtain basic information about the national land surface, with the idea that this information would eventually serve as a decision-making base for the better use of the different soils and resources of the country.

However, after almost two decades of activity along this line, we find ourselves with the dilemma that decision-making problems for better soil use prevail in spite of the current available information: In addition new organizations are still being created with the illusion that they are the ones to offer the final solution to the problem. As an example of this, we have the formation of the National Commission on Arid Lands (Comision Nacional de Zonas Aridas, CONAZA), the National Hydraulic Plan (Plan Nacional Hidraulico), the Tropical Development Plan (Plan de Desarrollo del Tropico), and the creation of the Rainfed Agricultural Districts (Distritos de Temporal), which, together with the old watershed commissions, such as the Papaloapan Commission, The Balsas Commission, the Grijalba Commission, etc., try to regionalize soil and soil resource decision-making with the idea that a regional focus can be more adequate for this objective. Obviously, there have been great advances in many of these areas but, the overall

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[1]Paper presented at an International Seminar on Social and Environmental Consequences of Natural Resources Policies, with Special Emphasis on Biosphere Reserves, held in Durango, Durango, Mexico, April 8-13, 1980.

[2]National Institute of Research in Biotic Resources, Xalapa, Veracruz, Mexico. General Director and Head of Ecological Land Use Planning Program, respectively.

objection of obtaining an ecologically sound planning program for soil resources and land use has not been attained.

Currently, the problem is of such a magnitude that the process of deforestation, erosion, siltation of reservoirs, rivers and lakes and the growing loss of tillable soils is, without a doubt, one of the biggest problems our country will face in the future.

It is necessary to mention that the problem of land use planning becomes very complicated in a country like ours in which there is almost complete liberty of land and soil resource use and where the only legal instruments available to the state are difficult to use on such a confused and hard to define problem. How can a government punish a poor rural peasant who, to survive, has only the alternative of destroying a forest and using forest soils for inefficient agricultural uses? How can a government change a city like Mexico City, established many centuries ago with an urban-industrial infrastructure, because we now know it to be completely inadequate? In fact, many of our current problems are nothing more than the accumulation of past errors which have grown to such a magnitude that their solution is very difficult and occasionally impossible. This is especially true in a country like ours where the individual liberties which are guaranteed by the constitution, are frequently the source of the problem affecting the resources which are the heritage of our country.

Evidently, this problem is not exclusive of Mexico, nor of economically similar or underdeveloped countries, but also of capitalistic as well as socialistic countries and economically mixed countries. Perhaps, the consequences of poor planning are simply more evident in poor, developing or underdeveloped countries.

After presenting this gloomy panorama of ecological land use planning, we would now like to examine a few existing alternatives which we have been developing at our Institute. We expect that these alternatives will start us in a new direction in the more rational and conservationist use of all our renewable natural resources.

The essence of this entire process lies in identifying who shall make the decisions and what will be the instruments available for making these decisions. In Mexico, there is now a great diversity of decision makers on several levels. The rural farmer decides which crops he will plant in a given year and whether or not to cut a new area for more crops. The agricultural bank authorities decide what kinds of credit to approve in the next year and which will have priority in relation to investment security or other factors. The state governments set their own policies and priorities, while the federal government sets national policy in relation to food and other product production and soil, water, and biotic resource conservation.

Within these extremes, the importance of the decision is decidedly very different. For instance, the decision a small group of people might make to construct a reservoir will greatly affect the resources and environment of a large region, while the impact of the decision of a local farmer to open up a small parcel in forested soils will be more limited in scope. However, the aggregate of all these decisions forms the national panorama of our natural resource and land management.

Obviously, such a decision-making problem has no easy solutions. It would be wonderful to have a cartographic method that could provide each interested party with the ecological criteria for the best use of its resources and soils and which could be implemented on a national level.

In fact, the cartographic works of the past tend in this direction, but they haven't been used as such because it is practically impossible to assign one single alternative to each site and have the alternative be ecologically, economically, socially, and politically sound. For example, we could identify a marshy area as very important to conserve from the point of view of flora and fauna, but, if oil is discovered in this area, the economic factor will obviously prevail over all conservationist arguments, whether we like it or not. For this reason, the economic, social, and ecologic costs of alternative action as well as possible solutions to problems that might arise with conflicting resource and land uses, must be taken into account.

With this as a background, through our research program on Land Use Planning, we have tried to develop methods that can be used by different types of decision makers, and that enable the users to evaluate the different costs of specific decisions by themselves, aided by the data and analysis tools that are provided. In this way, the decision maker can judge which is the best decision, without requiring that scientists be called in to make the final assessment as is usually the case.

The idea is essentially as follows: given a range of environmental conditions, each ecological zone can be used for different purposes with varying short- and long-term consequences which will include economic, social, and environmental aspects, and quality of life. Each use implies a transformation in the great majority of cases (with the exception of nature conservation, which also carries an investment and maintenance cost). For example, the decision to open a forested region up to agriculture, depending on the type of agriculture involved, will have an economic cost (such as the investment necessary for erosion protection if the soils require it) and an ecological cost, which could be the loss of genetic material necessary for the re-establishment of the former forest.

Many of these costs are not measurable in the same units and are difficult to compare. For example, what is the ecological cost of clearcutting one hectare? The cost could be very high if the area to be cut is the only one left in the region, or very low if it represents only a fraction of the ecosystem. How do you assign a numerical or monetary value to this cost? It would vary depending on the interest involved, i.e., the government, the people, and the landowners. It would also depend upon the quality of life expected by the society involved

(aesthetic or recreational value). In any case, it is the decision maker who must evaluate the pros and cons of each alternative on a global level before deciding.

This evaluation is by no means obvious and, due to the complex inter-relationships which are involved, the evaluation of the regional impact of a decision or of a series of decisions requires not only available data but a methodology which takes into account the complexity of the system.

To develop this methodology our group decided several years ago to choose the center of the state of Veracruz as a pilot area for this research. This area is a densely populated region of approximately 4,700 square kilometers, which includes a variety of ecological zones, a long tradition of use, and specific ecological, environmental, demographic, and economic problems. The steps taken in this research have been the following:

1. An exhaustive review was made of all the information available about the region: climate, soils, agriculture, cattle raising, forests, vegetation, water, economic factors, prices of crops, crop yields, ecological systems of cattle and agricultural production, etc.· Fortunately, the region, like many other regions of Mexico, has been well studied, and there is an abundance of information which has been gathered and which gives us a primary information base to work with.

2. Parallel to the gathering of this information, the principal ecological zones of the region were identified. For this, two dimensions were used; first, a macrodimension, which involved the selection of seven large land systems which were divided into 33 subregions (landscapes) using primarily climatic and physiographic criteria. The other dimension, on a micro level, includes the classification of distinct ecological zones called terrestrial units, or land forms, within the subregions. For example, there could be an area x subdivided into slopes, hill tops, valley bottoms, etc. These units were mapped using satellite imagery, aerial photographs, and field surveys. The idea is that using this classification system, any site within the region can be easily classified.

For each of these units, an attempt was made to relate all of the information available from the literature, statistical data, and field surveys to determine the different uses which had or could be planned. Potential erosion data was included in this as a function of climatic and soil data and especially, soil fertility and the agricultural history of each zone. Given the importance of the productive potential of each unit and the impossibility of being able to count on prior information on productive potential, corn was chosen as an indirect indicator of the productive potential of all zones as it is the only cultivated crop found in practically the entire region.

As a result of the large quantity of data that had to be analyzed, it was decided at the beginning of the project to use computer simulation and optimization techniques to condense the information into a form that could be used in the planning process. Linear programming as well as goal programming was used, and the method was tested by playing simulated planning games on the entire region.

In a simple way, what our method does is as follows: a decision maker, which could be many different types, can go to a computer terminal and, for a specific region identified by him through cartographic methods and ecological profiles, ask the computer, for example, what would be the regional consequences of changing a coffee plantation into grazing land. The answer would be given as the cost of the transformation, the expected investment and profits in the short-, medium-, and long-run, the amount of labor generated, expected erosion level, etc. With all this information, the decision maker will be the one to decide whether or not to continue with the plan or change it for another that would be better for him and the community.

In the case of our application of the method to the center of Veracruz, this type of model has allowed us to study the carrying capacity of the region under different alternatives or scenarios, and study the regional impact on land use as a function of the demands made by a growing population.

In effect, the study area had 603,000 inhabitants in 1978, 48 percent of which were urban. Our projections show that this population will double by the year 2,000 with 1,190,000 inhabitants, 63 percent of which will be urban. The level of food consumption of an urban resident, according to a study done in the region, is 2.5 times that of a rural inhabitant. then the pressure exerted on the natural resources of the region will grow explosively in the next years. Therefore, it is important to understand more deeply this problem as well as the possible alternatives: more technology, mechanization, education, etc. Which of them will be more relevant, or will be the most limiting factor for an increase in production in the region? Also, what will be the ecological cost associated with each one of them?

For a particular scenario, the model integrates, for example, the optimum use of the land as a function of the objectives set by the user, as well as the demand and distribution of labor, the amount and distribution of erosion, the amount and distribution of profits generated, etc. A great advantage of our method is that some of the factors are variable, such as the price of crops or grains, since the economic factor is the crux of decision making in practically all of the models. For example, a rise in the price of fertilizer can result in certain crops which require large quantities of fertilizers not being economically feasible. While others that do not require fertilizers being feasible. With the methodology, the fragile zones can be analyzed.

In this very condensed form, we have presented to you the contributions that the Federal Government, through our Institution, is making toward a more compatible process of economic development of our country with the utilization of

ecologic and scientific criteria which, in a free environment, can organize or punish licentiousness in the use of natural resources. The method is now available and can be adapted to almost any part of the Republic.

In conclusion, we wish only to say that the work up to now indicates that the road to ecological planning of land use in our country may lie in methods like the one we have been developing. It should be noted, however, that this implies a new assessment of the problem of natural resource planning and a fundamental change in decision making with respect to what we have had in the past. We think that this is a good doorway into the future.

This focus is also being followed, with some differences, in other countries with which we have had experience. Our work is a Mexican contribution to the MAB program of UNESCO, and we have shared experiences with the MAB committees of the United States, Australia, Venezuela, and Argentina.

Figure 1.--Improperly used land can reject human societies.

Figure 2.--The once great have fallen.

Grazing, Natural Resource Policy, and the Biosphere Reserves[1]

Warren P. Clary[2]

EXPERIENCE OF HISTORY

Civilized man, it is said, marched across the face of the earth and left a desert in his footsteps. Although this is an exaggeration, civilized people have greatly damaged most of the lands on which they have lived for a long time. This damage has been a primary cause for the decline of societies in older, settled regions of the world, and a major factor in historical trends.

History writers seldom note the importance of land use. They have not recognized that the destinies of most societies were determined largely by the way the land was used (fig. 1). While recognizing the influence of environment on history, historians failed to also recognize that people usually changed their environment. Many poor peoples of the earth are poor today because their ancestors wasted the natural resources on which present generations depend.

Historical records of the last 6,000 years show that civilized people, with few exceptions, were never able to continue a progressive society in one locality for more than 30 to 70 generations (notable exceptions were the Nile Valley, Mesopotamia, and the Indus Valley). The average time span was 1,000 to 1,500 years. After a few centuries of growth and progress, in most situations civilizations declined, perished, or were forced to move to new land. These civilizations had declined in the same geographical areas that had nurtured them mainly because the people ruined the environments that had helped them develop the civilizations.

Civilized people ruined the environment by cutting down or burning the forests, by denuding the grasslands through overgrazing by livestock, by killing much of the wildlife and fishes, and by permitting erosion to rob the land of productive topsoil. They allowed eroded soil to clog the streams and fill reservoirs, irrigation canals, and harbors. In many cases they wasted easily mined minerals. Thus, the civilization declined or the people moved to new land. As many as 30 major civilizations followed this road to ruin. Across Asia and in Europe and North Africa are seats of former leading civilizations that are now among the backward areas of the world (fig. 2). Many of these lands from whence our western civilization arose were once productive but are now largely impoverished.

The misuse of natural resources by overgrazing and other exploitation is not limited to ancient peoples. A more recent example is the arid and semiarid western rangelands of the United States. These were exploitively grazed in the late 1800's and early 1900's. By the 1930's western rangelands had been depleted to the point that the grazing capacity for domestic livestock was less than one half of what it had been when in virgin condition. Valuable, palatable, and nutritious forage plants disappeared and were replaced by plants that were often unpalatable, poisonous, or

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[1]Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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Figure 3.--Floods that had occurred soon after excessive grazing of mountain watersheds exceeded any of recent geologic time.

unreliable annuals. Also, accelerated soil erosion on seriously affected areas destroyed the ability of the site to attain its original productivity. All this reduction of livestock carrying capacity occurred within a 20 to 50 year period, and, in some cases, in as little as 10 years.

A more specific example is in Utah. In the 40 years before 1930, floods increased all over Utah. Floods and mud-rock flows originating in mountain canyons apparently exceeded anything that had occurred there for thousands of years. Boulders weighing as much as 200 tons were carried into the valleys, farmlands were ruined, homes and lives were lost (fig. 3). Soils, with depths equivalent to that which had developed in the 8,000 to 10,000 years following the recession of pleistocene Lake Bonneville, were lost in a few years. Investigations revealed that this serious situation had occurred soon after settlement in the latter portion of the 1800's.

Many other examples exist in the western United States. Often serious flooding and erosion began within 15 years after settlement and heavy grazing with sheep and cattle.

Human degradation of the land is called "desertification." The most obvious example is in North Africa where abuse of the vegetation has allowed the desert to continually expand. The problem is not limited to North Africa, but occurs on all major land masses. This means the long-run survival of our civilizations may be at stake. The eroded lands upon which many early civilizations were based now support only about one third the population they supported in ancient times. In addition, many of these people live in a rather impoverished condition compared to much of the world.

Will our modern civilization begin to practice true and full conservation, or will our conservation efforts be like those of all the ancients--too little and too late? The habit of destroying the natural resource base where people live is as old as civilization. It will not be easy to change our ways. The odds favor a continuing steady decline in the basic stock of topsoil in all our countries. Only science aided by proper natural resource policy can sidetrack civilized people from this historic pattern.

NATURAL RESOURCE POLICY

The proper use of natural resources must begin with knowledge--knowledge of what must be done to preserve the natural resources upon which we all depend, and knowledge of how to use the land's productivity in an effective manner. The application of natural resources knowledge comes in part through natural resource policy. We must be aware, however, that the simple existence of a policy does not guarantee appropriate use of the land. For example, natural resource policy played a role in the improper practices of early settlement years in the western United States. Among other things such policies:

1. encouraged a fragmented ownership pattern that made proper grazing management almost impossible;
2. encouraged plowing of lands too dry to farm; and
3. allowed unrestricted common grazing on public lands.

Improper use of the land was virtually assured when these policies were added to the early settler's lack of knowledge about arid lands and their pioneer philosophy that natural resources were nearly inexhaustible.

Since these early days, land use policies in the United States have generally improved--particularly as they apply to publicly owned lands. There has, however, been some vacillation between conservation and exploitation depending upon changes in public opinion, leaving natural resource policy in a continual state of change. Some of the stronger moves toward protection of the resource includes establishing Forest Reserves for watershed protection in the early 1900's, passage of the Taylor Grazing Act in the 1930's, and a number of environmental laws in the 1970's. During intervening periods, there were pressures to reduce the resource protection efforts. Currently, in the western United States, a movement called the "Sagebrush Rebellion" seeks to attain State jurisdiction over Federally owned lands. Many fear this movement could result in less protection for resources.

Many countries are working to develop knowledge and technology that would allow people to benefit from the limited productivity of arid and semiarid lands, while at the same time conserving the lands for future generations. Many of these efforts were described at the First International Rangeland Congress in August, 1978, at Denver, Colorado, USA, where information from 39 countries was presented. The combined social, political, and biological aspects of managing native grazing lands were given high visibility in this meeting.

An example of knowledge development encouraged by natural resources policy is the considerable research conducted on management of arid and semiarid grazing lands in the United States. Many Federal and State agencies and universities have research programs on the management of domestic and wild grazing animals, physiologic and ecologic requirements of native forage plants, and reseeding or other techniques for reclamation of areas depleted due to overgrazing, cropping, surface mining, or natural disasters. The application of the resulting knowledge has improved many western United States grazing lands (fig. 4), although much additional improvement is necessary.

For those unfamiliar with grazing technology, excellent sources of information are publications from the Society for Range Management, an organization dedicated to proper management of native grazing lands. This international professional society is headquartered in Denver, Colorado, USA and has an active Mexico section.

Figure 4.--Depleted grazing lands can be restored.

BIOSPHERE RESERVES

How do the Biosphere Reserves fit into this picture? The concept of Biosphere Reserves involves a broad philosophy of conservation. The objectives of the reserves include:

1. to conserve communities of plants and animals for present and future use and to safeguard genetic diversity of the species;
2. to provide areas for ecological and environmental study; and
3. to provide facilities for education and training.

Each reserve is to be a "conserved" area that can be studied.

Soil loss, especially as it relates to grazing, is often not as spectacular in other areas as it was in turn-of-the-century Utah. More typically, it has occurred slowly over longer periods. Thus, most people are not aware of the problem even though the productivity of the land may be decreasing each generation.

The Biosphere Reserves should provide those who set natural resource policy or who use the land with better understanding of the long-term dangers of improper management and knowledge of how to better manage the land for present and future generations.

Integration of Wildlife and Other Natural Resources Policies[1]

Peter F. Ffolliott[2]

INTRODUCTION

In any country, wildlife resources must be managed in accordance with long-range policies based on knowledge derived from thorough biological research and on administrative practicability. Furthermore, in formulating policies, the impacts of wildlife resources management should be considered in a multiresource framework. Only within such a framework can an integration of land uses be achieved for wiser use and conservation of all natural resources.

To formulate wildlife management policies in a multiresource framework, fundamental concepts of sensible resource administration implemented to meet the local problems must be incorporated. Also, an understanding of how these policies can impact, and be impacted by, other natural resources policies is necessary.

FUNDAMENTAL CONSIDERATIONS

While not inclusive, the formulation of policies for the management of wildlife resources should be based, in part, upon the following basic concepts:

1. Maintenance or enhancement of the existing standard of living for a steadily increasing population requires maximum production of food, fiber, and minerals. The management of wildlife resources must be consistent with this need.

2. Maximum yields of wildlife resources, for both consumptive and nonconsumptive purposes, are dependent upon a well-advised land and water management program. Therefore, management practices conducive to maximum production of wildlife resources should be integrated with forestry, other natural resources, and agricultural programs.

3. Optimum populations of wildlife species depend, in large part, upon the maintenance of favorable environmental conditions and upon a balance between these populations and their environment.

4. Harvest and utilization of wildlife resources (in particular, of game species) should be determined by species abundance and reproductive capacity in relation to existing habitats. Emphasis must be placed, if possible, on real or potential value, rather than on artificial values derived from custom or prejudice.

5. Wildlife management employs a variety of procedures to maintain (or otherwise modify) existing harvest and utilization practices. Since no single method is adequate, all methods should be used to the degree warranted by their proven value and utility. These practices include environmental control, regulation of harvest, refuge establishment, artificial propagation, stocking and predator control, etc.

6. All wildlife management should be based upon the findings of adequate biological research modified, if necessary, to reflect local conditions.

7. Sensible administration of wildlife resources depends upon the continuous services of all members of a well organized and cooperative porfessional staff. These staff members should be selected on the basis of both adequate training and professional competence, and they should have guaranteed tenure free of political interference.

8. Agencies and organizations administrating wildlife resources should have complete discretionary powers for the setting of hunting seasons, bag limits, methods of harvest, etc.

9. The success of any policy or program for the management of wildlife resources can only be gained through the support of an enlightened public. Therefore, a program of education and publicity should be an integral component of any wildlife management plan.

IMPACTS OF WILDLIFE POLICIES ON OTHER NATURAL RESOURCES

Implementation of a policy for the management of wildlife resources can impact the use of other natural resource products and uses. These impacts should be recognized to integrate wildlife and other natural resource policies.

For example, harvesting regulation should be used as a tool to permit the highest possible take compatible with sustained yield determined by prevailing biological potentials and environmental conditions. However, continuance of a particular harvesting regulation policy may restrict forestry, other natural resources, and agricultural programs if these latter programs drastically alter the environment.

Refuge programs should be developed to protect vulnerable wildlife species from excessive hunting pressures. Such programs must be flexible in nature

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[1]Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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Figure 1.--A habitat improvement practice designed to increase food for wildlife in the southwestern United States.

so that they can meet changing needs. Refuge programs should not be administered in such a manner as to "lock up" wildlife resources which, at the same time, could limit utilization of other resources.

Wildlife is a product of and dependent upon a suitable environment. In areas where deficiencies in food and cover (either protective or thermal) are limiting, habitat improvement practices may be necessary. It is important that, if implemented, these habitat improvement practices do not restrict the flow of needed products and uses derived from other resources (fig. 1).

IMPACTS ON NATURAL RESOURCES POLICIES ON WILDLIFE RESOURCES

Just as the implementation of wildlife management policies affects other land and water management programs, these programs impact the administration of wildlife resources. To insure wildlife management in a multiresource framework, an understanding of these latter impacts must be incorporated into the policy formation process.

As suggested above, forestry, other natural resources, and agricultural programs may have to be restricted if they alter the environment to the extent that maintenance of a harvesting regulation policy is not possible. But, in certain situations, products and uses derived from these programs can be of more importance than wildlife resources in a local or regional economy. This being so, harvesting regulations will have to be brought into "balance" with the other needs.

Similarly, refuge programs which protect vulnerable wildlife species from hunting may also limit the utilization of other resources. If demands for these other resources so dictate, policies relating to refuges may have to be redirected.

Whether designed to or not, land and water management programs often change wildlife habitats. In many instances, a complementary result of these programs is the enhancement of habitat conditions. However, some programs can have detrimental consequences in terms of food and cover available for particular wildlife species. In either case, an analysis of "trade offs" among resource products and uses is necessary to integrate wildlife and other natural resources policies.

EDUCATIONAL POLICIES

As previously mentioned, the success of any policy relating to wise use and conservation of natural resources depends upon the support of the people to be affected by the policy. To a large extent, this support can only be obtained through effective educational programs. It is here where the framework of Biosphere Reserves can play an important role in providing a setting in which alternative wildlife management policies can be evaluated prior to operational implementation, and then the best course of action can be selected. With specific respect to wildlife resources, certain educational policies should be encouraged:

1. The people should be informed of the reasons for and the problems involved in wildlife management programs, particularly in the context of multiresource utilization.
2. Educational programs should emphasize that the mechanisms controlling wildlife populations are extremely complex, that research investigations of these mechanisms are in order to establish a basis for efficient management of these populations, and that continually changing environmental conditions may require new and changed management procedures.
3. The findings of research should be published (or otherwise disseminated) promptly in the interest of advancing wildlife management, locally, regionally, and nationally.

When formulating wildlife resources policies, fundamental considerations, impacts of these policies on other natural resources, impacts of natural resources policies on wildlife resources, and educational policies must be integrated. Through this multiresource framework, an integration of land uses for wiser use and conservation of all natural resources can be achieved.

Wildlife Management:

White-Tailed Deer in La Michilia Biosphere Reserve[1]

Sonia Gallina and Exequiel Ezcurra[2]

INTRODUCTION

Wildlife is a natural resource that has never been fully appreciated nor adequately utilized in Mexico, and it has suffered severe deterioration in many parts of the country. We feel that wildlife conservation and management, more than a legal problem in need of more regulation, is a cultural and socioeconomic problem that has led human populations to a poor use of natural resources often against their own traditional customs and uses. Only by including people into the natural resource protection programs, so that they understand that they have a resource in wildlife that must be used over the long term, can we establish a true protective policy.

The Institute of Ecology in Mexico City, recognizing the urgent need to conserve fauna, has taken great efforts to determine the best use of this resource. This is why research in the Biosphere Reserves of Durango is directed toward analyzing the functions of ecosystems. We need to understand the biology and ecology of the different species, population dynamics, and interaction with the other components of the ecosystem.

THE STUDY

On La Michilia Biosphere Reserve in the south, south-east of Durango since 1975, we have been studying the white-tailed deer (Odocoileus virginianus), an important game species for the country and a species having a large distribution in Mexico. The objective of this work is to study the population behavior as it now exists on the Reserve, and to establish a general mathematical model to predict changes in the population and devise better management techniques.

Food Habits

The first step was to determine the white-tailed deer diet and its seasonal changes, using microscopically analyzed deer pellets and identifying the eaten plants by the epidermis which remains throughout the digestive process. The results published by the Institute of Ecology in 1978 were: a major part of the diet consists of bushy plant species (51 percent), followed by tree species (32 percent), and grains (2 percent), and the most common species eaten are: mistletoes (Phoradendron bolleanum and P. villosum), manzanita (Arctostaphylos pungens), other species of Arctostaphylos, gatuna (Pithecellobium leptophyllum), buckthorn (Condalia hookeri), junipers (Juniperus deppeana and J. durangensis), oaks (Quercus spp.) and madrone (Arbutus glandulosa).

The diet of white-tailed deer changes seasonally on the Reserve, according to plant availability. In the summer rainy season, deer eat many herbaceous plants, most of which are annuals. This preference is related to forage quality; growing species have a higher nutritive value and are more palatable for the deer.

Because of the number of plant species consumed (135 individual species), deer are considered to be generalist herbivores. This is an advantage for the species because it permits it to more easily adapt to vegetation changes (if they are not too drastic) and to live in a variety of habitats as long as food and cover are available.

On La Michilia Biosphere Reserve, deer feeding areas are well defined, located on the high mesas and slopes where an open pine-oak forest develops with distinct dominant species and a good growth of bushes and herbaceous plants which are ideal as a dietary supplement. Besides forage, deer find cover in these areas where it is easy for them to perceive danger at great distances and flee more quickly from their predators (e.g., puma, coyote, bobcat, and man).

The white-tailed deer on the Reserve must share their habitat with cattle which constitute the most important economic activity of the region. This is why it is important to learn the basic aspects of the feeding behavior of the two species of ruminant herbivores to determine their relationship as possible competitors for the food resources in the ecosystem they inhabit.

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[1]Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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With respect to the feeding habits of cattle, we have only made a few direct observations. We hope that this year we can quantitatively study the diets of both herbivores to determine the real level of competition.

According to our observations to date, cattle eat mainly grasses (54 percent of all plant species eaten) and forbs (24 percent), and consume bushy and tree species mostly during the dry season. For lack of detailed quantitative information on the dietary habits of cattle, a first approximation of the overlap between the diets of cattle and deer has been obtained by calculating the proportion of plant species common to both diets for the dry and wet seasons, according to Sorensen's formula:

Plants	Dry Season	Wet Season
Grasses	0	0.53
Forbs	0	0.34
Bushes	0.24	0.38
Trees	0.18	0
Total	0.13	0.35

These data, based on a simple plant species list, seem to indicate little overlap between the two diets, especially during the critical season. Competition for food can be analyzed more precisely once quantitative information on the diets of both species is available.

It seems logical, however, that competition is not very high if we consider the following facts:

1. In spite of the fact that cattle eat some bushy and tree species, which are basic to the diet of the deer, these plants are abundant on the Reserve.

2. Cattle are kept on pastures that are rotated every year, while the deer roam freely.

3. Cattle receive dietary supplements of "harinolina" and oats during the critical dry months.

4. The diet of cattle is based on grasses, while that of the deer is based on bushes and trees.

According to available information, it is possible to affirm that the white-tailed deer is an exploitable species in cattle ranching areas similar to La Michilia. With the establishment of combined management of the two species, white-tailed deer can be a source of extra income for ranchers and ejido members.

Population Evaluations

Every wildlife population management and research project must include the periodic evaluation of animal numbers. This is essential to establish management standards, bag limits, hunting seasons, etc. In the case of La Michilia, the problem is complex because capture introduces a higher mortality factor in a small population, and because the abrupt topography makes direct observation or capture extremely difficult.

For this reason, it is necessary to develop methods of sampling and population analysis that conform to these limitations. On La Michilia, we have used two approaches to the problem: the evaluation of deer pellets and the evaluation of browse plants eaten by the deer. The first is more objective and lends itself to a more vigorous statistical analysis. The second method has given lower estimates because investigators often underestimate the parts of the plants that have been eaten; this method serves as a form of check and verification of the results of the first.

To calibrate the methods for La Michilia Biosphere Reserve, we used a pen with a small number of animals. In this way, it was possible to verify the accuracy of the pellet data and the adequacy of the sample. This method of analysis has provided valuable information on the deer populations and yielding more data than what we initially expected. The most important results are as follows:

1. The distribution of pellet groups in the field is clumped, which indicates a marked habitat preference by deer, a well-defined social behavior, or both simultaneously.

2. The clumping of pellet groups shows a marked positive density-dependence in time as well as in space. This implies that population sociability increases with density. With low density, deer are less gregarious; with high densities, they are more grouped together.

3. Deer population densities on La Michilia tend to decrease. This could be due to: illegal and indiscriminate hunting in the areas surrounding the Reserve, a cycle in the dynamics of the population, or migration away from the area. There are still not enough data to clarify this point; our next investigations will be directed toward this problem.

4. Among penned animals, there was a marked relationship between pellet size and animal age. Based on this evidence, we determined the age classes of the penned deer at La Michilia, and determined that predictions are valid. This allowed us to estimate the age classes of the animals in the field. These demonstrated the characteristic oscillations of a population which is unstable in its age distribution.

Although research is still in progress, it is possible to extract two conclusions from the population studies:

1. It is possible to use indirect methods to evaluate the state of the populations of animals

with an acceptable level of precision. This is important in the philosophy of resource management. On La Michilia, we have replaced capture sampling methods with fecal analysis and browse plant analysis. The lower accuracy of the indirect methods can be compensated, in large part, through larger sample sites and more elaborate statistical analysis. This method of investigation permits the study of a small population without altering its structure. On the other hand, it confers more authority to the opinion of the researchers when they demand conservation of the natural resources.

2. The deer population on La Michilia Biosphere Reserve demonstrates a tendency to decrease, with oscillations in age structure which are greater than can be expected in stable populations. We suspect that there is either intense migration from the area or an extraordinary cause of mortality. Migrations could be related to the availability of water during the dry season; the mortality could be related to illegal hunting. While the causes of the decrease are being studied, more control of hunting in the surrounding areas of the Reserve is needed until the deer population returns to an exploitable level.

Integral Development of the Rural Communities[1]

Armando Ochoa[2]

INTRODUCTION

For a Biosphere Reserve such as La Michilia, conservation, ecologic research, and the acquisition of technical and scientific personnel with the knowledge necessary to manage the Reserve is not enough. The resolution of social and economic problems of the human settlements in and near the reserve must also be given high priority.

The most needy residents of the towns of the periphery of La Michilia Biosphere Reserve, of which San Francisco de Mezquital, Suchil, Vicente Guerrero, Nombre de Dios, and Villa Union stand out, together with the heads of many other municipalities with multiple needs, have been pressuring the Agrarian Authorities to divide the forest. Establishment of the Reserve has opened a new door, providing these people with the opportunity to seek and find valid alternative solutions to their demands for social justice. Until now, the only palliatives for these people have been principally migration to the big cities or enrollment into the ranks of the undocumented.

The most serious damage caused by the loss to a region of its most capable and willing element is through decreased farm and related production, creating discouragement and frustration in those who stay in the communities.

Of the slightly more than one million hectares which represent the total land surface of the five municipalities mentioned above, only 6.4 percent is used for agriculture; however, only a much smaller percentage is appropriate for that activity. In the municipalities of Mezquital and Suchil, there are large forested areas, but their exploitation is weak and technologically lacking.

In the valley which includes Suchil, Vicente Guerrero, and Poana, thick brush, mesquite, huizaches and prickly pear predominate. In the best of cases, these lands can be used as pastures for cattle, horses, sheep, or goats. Livestock production in this valley is, in general, a marginal activity and is economically important.

Of those lands destined for agriculture, one-fourth is irrigated and used mainly for the cultivation of beans, chiles, and wheat. On the seasonal (unirrigated) land, only corn and beans are cultivated, with a productivity per hectare of 800 and 700 kilograms, respectively, quantities insufficient for the consumption of even one family.

According to the 1970 census, the ecomonically active population of these municipalities was only 21 to 25 percent of the total, most of which was in agriculture, livestick production, and silviculture. Only 8 percent of this economically active population received more than the minimum wage.

The vast majority of the approximately 150,000 inhabitants of these municipalities demonstrates visible deficiencies in diet, housing, dress, and education. Because of malnutrition and the lack of hygiene, disease (especially in the form of parasities and infections) is a serious problem affecting a large part of the population.

Up to now, I have mentioned only the need for permanence of the Reserve in relation to the conditions of the landless rural poor, but we must not forget that there are other pressures which are almost always more influential for the decision makers. These pressures come from those who see these areas as a source of easy and quick riches, or of private family diversion without a thought to the deterioration or exhaustion of the natural resources, and would, through the system, exclude the benefits from those who live on or near the area and who, in reality, have more right to them.

THE INTEGRAL DEVELOPMENT PROGRAM

The research program that the IPN has been managing since 1974 in the State of Durango (through its Center for Interdisciplinary Research for the Integral Development of the rural community, CIIDIR), is trying to raise the standard of living of the residents of the five municipalities around La Michilia Biosphere Reserve, as well as carry out the institutional objectives which gave rise to the Polytechnic Institute. This program is based on ecodevelopment, which will make it possible to attend to both material human needs and the preservation of the environment. At the same time,

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the program methodology includes the five well-defined stages described below:

1. Develop a deep understanding of the regional problems, the manner of thinking of the people that live there, and their fears and aspirations. In other words, be totally cognizant of the social, economic, and political situation and of the real, actual, and potential possibilities for the development of the region.
2. Establish and rank (with the members of the community) the most viable solution alternatives.
3. Once the problem and a cooperative plan of action with the community are identified, begin the projects which appear to resolve the problems. This is done with clear objectives and precise fulfillment and timing goals, with emphasis on involving as many of the rural population, ranchers, and Ejido and municipal authorities as possible.
4. Consolidate the programs initiated in the third stage and complement them with the generation of agroindustries.
5. Integrate the activities designed to achieve the final objectives of the Program of Integral Rural Development. Those objectives are: creation of employment, production and distribution of food, integral health of the population, education, and the conservation of the environment.

The author, who is also the initiator and promoter of the first projects (along with some of the participating researchers) are natives of the region and have not lost contact with the people and their reality. We feel that we understand the problems of the people and are able to collaborate in the formation of options to provide effective solutions.

Through this understanding, and through discussions and analyses carried out in many meetings with ejido members, small land owners, businessmen, professionals, students, and political authorities starting with the State Governor, we arrived at the resolution that we must reinforce, through experimentation and various supportive works of the primary production activities, the following: agriculture, livestock production, fruit production, and silviculture. These activities constitute the base of the local and, in general, State economies and generate the few commercial and industrial activities of the area. The experiences and interests that the people, especially the rural workers, have in these activities permits us to establish communication with the people and, consequently, facilitates the promotion of technology, research, extension, consultation, and education.

More than five years have passed since we brought together (in Vicente Guerrero) a group of farmers, Ejido presidents, the municipal president of Vicente Guerrero, the representatives of several state governmental agencies (the General Directorate of Public Education, the Directorate of Development, and the Agriculture and Livestock Delegation), and some IPN researchers, to tour the area. Several parcels and orchards near San Francisco Murguia, San Pedro Alcantara, Presa Santa Elena, Vicente Guerrero, and Gabriel Hernandez were visited. From the observations, comments, and recommendations that came up during the trip, a concrete idea with possibilities as a research topic was formed: the cultivation of strawberries for plant and fruit production. We had seen a family patch in San Francisco Javier with some plants producing fruit, and during conversations with Ejido members that were cultivating corn in Gabriel Hernandez, we were told that in the preceding years they had planted some strawberry plants which had dried up for lack of irrigation.

The cultivation of strawberries fits in very well with the goal of experimenting with a crop which would need much human labor, be of high yield, require some technology, and have industrial possibilities. In March of 1975, we established, near Francisco Murguia, a greenhouse on a quarter hectare of a small farm. With the progeny of the plants of that greenhouse, we extended the crop to a little less than a half hectare for fruit production (which began in April of 1976 and lasted until August of that year producing strawberries during the same period of the next year). In 1978, the Governor of the State helped us get a loan from the National Rural Credit Bank, and it has been renewed up to this date.

I have tried to give a detailed description of the procedure we have followed, using as an example only one of the studies. However, the rest of the projects that comprise the following programs: Introduction of New Crops, Use of Plants in Arid Zones, Integral Health, Agriculture, and Creation of Agroindustries, followed the same methodology.

RESULTS

Introduction of New Crops

In 1979, we produced almost 80 tons of strawberries and more than 6 million plants, with a yield of 12 tons of fruit and 600,000 plants per hectare. This year, we have 12 hectares in production and the harvest has already begun, with an expected production of 250 tons (approximately 23 tons per hectare).

The plants are sold to agriculturists in Zamora and Irapuato; the strawberries, since last year, are being marketed in Durango, Vicente Guerrero, Lerdo, Gomez Palacio, Torroen, Chihuahua, Monterrey, Mazatlan, Culiacan, and in neighboring towns, in the following forms: bulk fresh strawberries, destemmed frozen strawberries, and sliced frozen strawberries mixed with sugar.

The investment per hectare in this crop has been close to 100,000 pesos, of which more than 70 percent is paid as salaries for soil preparation, plants, insurance, picking, destemming,

packaging, transporting, processing, etc. More than 20 people have enjoyed permanent employment in the project. Eventually (especially in harvest time), we expect to employ more than 120, mostly women and children. These benefits are in addition to those resulting from the impact of the project on the economy and services of the area. The packages used in transportation are mostly of wood cut to the right size in an Ejido workshop in Salto, Durango and assembled in Vicente Guerrero. Each wood box costs 15 pesos and will hold 5 to 5.5 kilograms. In Constancia, baskets which are used to sell fresh strawberries are made.

All this, up to now, seems simple and may give the impression that it was done easily and effortlessly. However, it has been difficult, and, at times, it seemed that we could not continue. There were moments in which we wanted to quit and justify our work by saying that the responsibility of the scientist is only to arrive at methods that work and can be reproduced, not to train and organize the rural, technical and support personnel; least of all to take responsibility for marketing a perishable product in the face of larger competition (we had to compete with the strawberries of Irapuato and Zamora). All of this and much more we had to do; otherwise, our data would be filed away in theses or scientific or informative articles without having been realized as an economic benefit for the marginal sections.

Another crop that has been tried with good results is broccoli, with a yield of 10 tons per hectare. This plant is resistant to low temperatures and high salt concentrations, and is, therefore, appropriate for the climate and soils of the region. We will discuss this in the agroindustries section.

Trompillo (prairie berry) is a plant of arid or semiarid zones and grows wild in Durango. It contains a protease useful in making cheese, and its cultivation was tried in the San Jose de Tuitan ejido with good results.

Amarando, or quelite (pigweed), is a plant that produces grain on large stalks. Its nutritive value is important because it contains proteins rich in lysine. This crop will be introduced with advanced techniques this year in "La Brena" region of San Jose de Tuitan.

We must make one thing clear about the cultivation of strawberries and broccoli. We do not intend to replace the basic crops of the region, corn, beans, and wheat, which are indispensible foods for the people. What we do intend is to use only a small percentage of the land which offers the opportunity for occupation by the landless and jobless rural population, especially during times of drought, such as last year. Besides strawberries and broccoli, there are other fruits and vegetables produced in the region, which we foresee as primary material for the agroindustry, that we have projected and which will provide work for a great number of men and women.

Use of Plants in Arid Zones

Within this program, in 1978, a project was begun which proposed, among other things, to utilize prickly pear (an abundant resource in the CIIDIR study area) as an ingredient, together with other available local products, with which to cheaply supplement the diet of cattle.

The huge losses in animal production due to lack of food during the dry season are common knowledge. This is particularly serious in the State of Durango and in much of the northern part of the country and causes the greatest losses in the disadvantaged areas (whose system of production is not very advanced).

This week, in the livestock producing Ejido of San Jose de Tuitan, the third experimental feeding trial was begun with hereford and mixed breed cattle provided by the Ejido. The results to date have been good on the experimental level, and it is now possible to extend the prickly pear-based diet to all the cattle region. The diet has proved efficient and affordable.

A stable with capacity for 70 animals has been established on land provided by the Ejido. The stable was built by the Ejido members from local materials and with advice from CIIDIR personnel. There are also three grinding and chopping machines for grain, various forage plants, and prickly pear, as well as a pilot digestor to begin trials for the production of organic fertilizer from animal dung.

This year, it is hoped that the races of cattle in the region will be improved through artificial insemination and other veterinary techniques.

In October of last year, because of the drought that afflicated the State, we presented to the Governor a livestock aid program, using the results and experience obtained in the Tuitan Ejido, with the intention that it be applied to the small ranchers with only a few animals. There is the possibility that we can help, with our direct participation, the organized groups of Ejido members and small farmers with livestock.

Again, we feel that it is not enough to publish and distribute this information through the mass media, no matter how simple it may be, because the farmers and ranchers would probably not understand it. We must work directly with them and have their participation from the start of the project so that they can see how it develops and learn about the problems and achievements as they occur. The rural development programs would yield few practical results if they were carried out exclusively in the laboratories of Mexico City. Experiments done within the confines of four walls would only result in giving prestige to the "researchers."

Integral Health

One of the fundamental activities of this program has been that which relates to community organization, and it has been able to mobilize the populations of Tuitan and Nombre de Dios for participation in the Critical analyses and resolution of community health problems. Neighborhood and sector health committees have been created in almost half of the community of Nombre de Dios, and we hope that all of it will be organized by the end of 1980.

In addition to the above, there are four basic programs:

1. attention to health;
2. school hygene;
3. infant care; and
4. auxiliary volunteers.

These are carried out according to the guidelines of the SSA and with the participation of the doctors in the service of the School of Advanced Medicine of the IPN and other universities.

Recently, an aid activity has been included in this program which, because of its influence and importance, should be mentioned. This activity deals with teaching preschoolers (3 to 6 years old) by the Montessori system but with adaptations to the needs, interests, and realities of rural children. This is done in the "Casa del Nino" (House, of the Child) of the Ejido colony of Vicente Guerrero. The project has encouraged the conscious and positive participation of parents and of the community, in general. The response and results have been very good. The General Delegation of the SEP in the State is now aware of this, and we hope that the system can be extended to other rural communities in the study area and to the entire State. Capable personnel will be trained by CIIDIR.

Apiculture

We initiated an apicultural program in the study area in 1977 with intentions to modernize and promote the production of honey for food and commercial purposes. The honey production per hive was traditionally around 10 kilograms per year; one year after starting our program, production rose to 50 kilograms.

There are now nuclei with varying numbers of hives in Santa Rosa, San Atenogenes, San Jose de Tuitan, Texcalillo, Los Molinos V., Union, and Suchil. The hives and their accessories are being made in Vincente Guerrero in the CIIDIR workshop.

We expect to produce apicultural technicians, through secondary technical schools and from the CECYT's located in the region, as soon as possible, so that they may take responsibility of the hives of their own communities.

The honey produced has been divided among the participating farmers on whose land or orchards the hives are kept. That part of the honey which goes to CIIDIR is sold at very low prices and in controlled quantities to prevent hoarding. This facilitates its consumption by the greatest number of people, since the objective is that the population enjoys an extra source of calories and minerals.

A floral study of the region has been undertaken to determine the total potential honey production. Once the apicultural technicians are available, the integration of apicultural cooperatives (such as the one in Sucuil, which is composed of professors, students, professionals, Ejidos, and small landowners) will be promoted.

Creation of Agroindustries

The need to produce food and make it available to the public requires organization and industrialization. The agroindustrial development program in the State of Durango, after the preliminary studies, has focused on the elaboration of two projects for two different undertakings:

1. A plant for the integral use of fruits and vegetables through canning; and
2. another plant for the use of these same materials by freezing.

A fruit survey, conducted as part of the preliminary work, indicates that apples, perons, pears, peaches, apricots, membrillos (Quince), pumpkins, and strawberries can be processed. On the vegetable side, we have tried the establishment of crops such as broccoli, and it is expected that cauliflower, cabbage, green beans, and peas can also be attempted.

This is a new and instructing experience as making the land produce is difficult and complex, and to organize that production for industrial processing creates even more problems. To resolve these problems, a group of competent people with experience in crops, industrial processes, and administration of this type of work has been integrated.

The choice and design of processes has been made by the group that works in Michoacan, as well as by CIIDIR. These projects include the production of jams, fruits in syrup, jellies, products with pumpkin and fruit bases, fruit nectors, pickled vegetables, and fruits and vegetables frozen by different processes.

In the organization of the above-mentioned activities, the producers themselves provided most of the investment. In this way, they were assured of receiving their products and the benefits gained from the transformation of the raw materials. The State Government will act as regulator while IPN will provide advice and human resources for administration and technical guidance of the projects. These projects should be functioning by the end of 1981 or the beginning of 1982.

As an additional aid to the research programs of CIIDIR, we expect to have 30 or 40 young people graduate or studying under scholarships in the high schools and centers for Scientific and Technological study of the region. We also hope to reinforce the research personnel of the center. Preference in recruiting will be given to the people of the surrounding communities or from the states of Chihuahua, Coahuila, Zacatecas, and San Luis Potosi.

Higher Research and Education in Natural Resources at the National Polytechnic Institute, Mexico[1]

Mario Luis Osoria Victoria[2]

INTRODUCTION

At the risk of being redundant, it is necessary to point out that the National Polytechnic Institute is the technical and scienfitic organ of the Mexican State whose origin obeys the postrevolutionary need to form scientific and technological codes to resolve the many problems that our country faced in the 1930's. The National Polytechnic Institute (IPN) since then has represented the most viable option for producing equitable development for the Mexican State and people.

The role (produced by the IPN) that the technicians have played in the national history has, on many occasions, been transcendent. This institution has formed many human resources, all integrated toward the process of productive transformation, which the Mexican society needs with such high priority.

The objective conditions that gave rise to the IPN have varied. However, the basic philosophical postulates of our Institution are still valid for modern conditions and will remain so in the short- and medium-term future. There are still many marked differences and class conflicts which produce notorious inequalities in the distribution of the wealth and services that society generates for each and every one of its members. The work of the IPN has, since its creation, been centered precisely on creating conditions that modify social injustice and place technology at the service of the country.

The themes of study that the IPN follow in the formation of human resources and research now cover almost all disciplines of human knowledge, but are basically confined to those whose orientation is eminently social or those which reality forces us to consider as essential for the independent development of our country. This is the case with the applied study of natural resources in Mexico.

NATURAL RESOURCES

Let us accept, to begin with, that there are those means of subsistence which are obtained directly from nature. For this reason, we must reiterate that their fundamental importance derived from the fact that there are means of subsistence for man, who has the capacity to transform them and adapt them to his benefit. In fact, the history of man could be written as his struggle to control the natural resources, not only by isolated man, but by society, including the kinds of production relationships that have been established by it. It is undeniable that the manner in which the natural resources are used or deteriorated depends upon the character of said relationships.

Nowadays, very few people believe in the deterministic ideas of Drs. Ratzel, Huntington, Haushofer, and others. Explanations are sought in a sociohistoric context and in the form of production that human groups might be capable of developing.

Nature, in short, is not the determining factor; the transforming role of man through technology to a better and more just organization of work and an equitable distribution of wealth generated by these activities, is the determining factor. Man should be the primary objective of the transformations. In synthesis, the exploitation of natural resources should be associated, theoretically and operationally, with the kind of productive system which characterizes the country or region under analysis. When the policy of those who control research and exploitation is to obtain the most profit with the least cost and in the shortest time, activities are concentrated into key areas and are carried out without thought to history. The result is that the reserves are used up, and the physical environment is transformed on the scale and in the manner which interests and is convenient for certain groups, with no account for national or local interests. This is something which all countries should honestly consider.

To adequately face the historic responsibility that the IPN has accepted relative to the study and exploitation of the natural resources of our country, it is indispensable to point out once more that our Institute is oriented by a basically nationalistic spirit which struggles to obtain results applicable to our conditions of social

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development. This permits the overcoming of deficiencies without compromising our sovereignty, nor the genuine feeling of independence and identity that all Mexicans have in their souls; with this orientation the IPN develops human resources of a distinct level.

Only since 1977, the number of masters programs increased by eight, four of them with their respective doctorates; one is in ecology, given in the National School of Biological Sciences. The postgraduate population of the school is on the order of 2,948 students, and 492 professors participate in its formation. The above is not only in the area of natural resources, but permits a wider perspective with which to view them.

The relationship between research and instruction is indivisible. Within the IPN, the developments of human resources are included in every research project, on the bachelors level, as well as on the masters or doctorate level. In effect, for every research project carried out in the IPN, human resources are formed and theses or monographs are produced whose value and scientific quality are widely recognized on an international, as well as a national level. The number of research projects to be finished in 1980 is 230, with a budget of 67 million pesos.

RESEARCH IN NATURAL RESOURCES

Practically every school or center of the IPN has at least one research project in the area of natural resources. For example, the National School of Medicine and Homeopathy is studying the biochemical, hematological and neurochemical modifications induced by Datura stramonium in rats.

The School of Advanced Medicine is working with a community Medicine Model in San Pedro Xalpa, D.F., where the influence of social relations and environment on the level of health and disease of the inhabitants of the neighborhood is being studied.

The Center for Interdisciplinary Health Sciences is analyzing the effects of ultraviolet light and photoreactivity in human chromosomes, an interesting study if you consider the conditions of atmospheric pollution in Mexico City.

In the School of Advanced Mechanical and Electrical Engineering, there are proposals to develop a system of reclamation of rain water. If you consider that 85 percent of the national area receives annual precipitation on the order of 300 millimeters, the importance of this study of natural resources is obvious.

The conversion of solar energy to mechanical energy is being studied in the School of Advanced Chemical Engineering and Extractive Industries.

Additionally, the School of Advanced Engineering and Architecture is doing research in the Mixtec region of Oaxaca (a vast disadvantaged area of the country) to utilize renewable, nonrenewable, and unlimited natural resources to aid the development of the region.

The National Center of Mathematics is aiding a research project called Conjunto, in which mathematic and economic models are used to model the urban growth of Mexico City.

The construction of a solar wood drying kiln is being developed in the Professional Interdisciplinary Unit of Engineering, Social, and Administrative Sciences. It is a project which will permit the more rational use of these natural resources.

Finally, in the National School of Biological Sciences, where a very important number of Research projects are concentrated, the following merit mention: "Biology of the majarra in Aztec Lake, Hidalgo," "Ecological studies of coastal systems," "Damage produced in several species of the Coatzacoalcos River by the pollutants lead and mercury," and others more related to the study and exploitation of the various natural resources. It is important to emphasize the participation of the Department of Nutrition Graduates. They are studying the national use of vegetative and animal resources for the food industry, which is an important aid to the National Food Plan. Besides all this, the studies tend to conserve the ecological relationships of the various resources studied. The work done by this department has frequently been rewarded in national events of high scientific quality.

In late 1979, the Directorate of Research and Technologic Development of the IPN with the Polytechnic community and the collaboration of several researchers, held five seminars to define the research policies. Information was gathered in areas considered to be priorities, which included those of energy, and food and ecology, whose relationship to the theme of this meeting is evident.

DECENTRALIZATION AND INTEGRATION OF RESEARCH AND EDUCATION

The research mentioned above, although related is not completely integrated at this time. The reason is that the IPN, through the Directorate of Research and Technologic Development, has given more cohesion to the lines of investigation that have been ongoing for many years. This policy has been fruitful in the creation of two research centers in the Mexican Province, precisely in the areas where the research is most needed.

The first attempt along these lines took place in the State of Morelos, in a study of the renewable natural resource Cuaguayote (Pileus mexicanus), an abundant fruit in the Yautepec region of Morelos. The importance of this resource lies in its high Mexicaina content, a proteolitic enzyme which can be substituted, with many advantages, for papaur, widely used in many industries and which has to be imported in large quantities

by Mexico in spite of the fact that the country is a primary producer of it. The research in this field has led to the consolidation of an Experimental Unit of the IPN, which will soon operate with more efficiency and, it is projected, on a national and international level. Another important earlier project that is in the State of Michoacan. The rational use of the soils of this region, such as the introduction of new productive techniques of greater social value, have permitted the creation of a processing industry of agricultural products and, consequently, the optimization of those natural resources. The first was accomplished while conserving the integral participation of the rural population with a technology that does not increase the dependence on the outside on a regional as well as international level.

THE INTERDISCIPLINARY CENTER OF MARINE SCIENCES (CICIMAR)

CICIMAR was founded in September of 1976 in La Paz, Baja California, with the objective of preparing groups of high level researchers specializing in the evaluation and design of fisheries systems (with special attention to marine ecology). With this, the IPN paid a debt and ended the absurdity that in Mexico, a country extraordinarily rich in marine resources, the only State Education Institute lacked a center like the one now operating in La Paz, Baja California.

CICIMAR is structured into five horizontally integrated research and education departments: fisheries, marine biology, oceanology, technologies, and aquaculture. From an educational point of view, there are Bachelor degrees in Fisheries Biology and Aquaculture. Postgraduate studies (Master of Sciences) were begun in 1978, and included specialties in Marine and Fisheries Sciences. Currently, there are 22 students in the first and 14 in the second. Classes are given by 16 specialists in various fields of marine and fisheries sciences, including three UNESCO experts. It is hoped that in 1980 the areas of Fisheries Biology, Marine Ecology, and Aquaculture will be widened.

Of the research projects now being carried out by the IPN through CICIMAR, the following merit attention:

1. evaluation and diagnosis of exploited fisheries resources;
2. evaluation of potential fisheries resources;

These two projects are currently studying such species as sardines, tuna, squid, mictofids, and other renewable resources considered useful to man.

3. a systematic-ecologic inventory of the marine flora and fauna of southern Baja California;
4. morphology of marine species;
5. evaluation of planktonic communities in Magdalena Bay (Bahia Magdalena) south Baja California;
6. an analysis of the variation in abiotic factors in ocean waters and protected waters of southern Baja California;
7. aquaculture: specifically shrimp and mussels; and,
8. industrialization of algae production.

The budget for these eight CICIMAR research projects was 10,204,840 pesos for 1980. It is also worth mentioning that the research being done in this center (which cannot be detailed more here) is an integrated and complete activity with a distinct ideology resulting from an institutional and national policy: decentralization.

THE INTERDISCIPLINARY RESEARCH CENTER FOR INTEGRAL DEVELOPMENT OF THE RURAL COMMUNITY, IPN DURANGO UNIT (CIIDIR)

In October of 1974, a group of IPN researchers initiated a series of studies in the southeast of the State of Durango. The basic goal of this group was to apply and decentralize research with a project called "Introduction of New Crops." In that year, they began a series of actions which, aided by the IPN, the Government of the State of Durango, and CONACYT, grew into the creation, in November of 1979, of CIIDIR in the City of Vincente Guerrero, 85 kilometers from the capital of the state, and with influence over 10,350 square kilometers distributed among five municipalities of the region.

The IPN through CIIDIR, is carrying out research of the highest level which is oriented toward the needs of the population it is intended to serve. The results of this research are turned into real benefits for the inhabitants of the region.

The structure of the Durango unit of CIIDIR-IPN is taken from the Modular System as applied to education and adapted to the needs of the center. There are five perfectly differentiated modules: integral community development, vegetative resources, animal resources, nonrenewable natural resources, and unlimited resources. Each module is subdivided into programs, projects, subprojects, activities, and tasks, and interdisciplinary research is propitiated vertically and horizontally and from module to module.

From an educational point of view, there are currently no formal courses at any level in CIIDIR. These activities are reduced to direct thesis counseling, short courses on specific subjects, and informal education of the community. It is hoped that by the beginning of 1981, a Master's program in Integral Community Health will be initiated in coordination with the school of Advanced Medicine.

Within the lines of research being followed by CIIDIR in the form of programs, projects, or subprojects, the following should be mentioned:

1. use of prickly pear and other arid zone plants;
2. determination of the organoleptic properties of natural jelly and its possible use in

medicine and cosmetology;

3. introduction of new crops;

4. proteolitic enzymes of "Trompillo" for the rural cheese industry;

5. apiculture;

6. study of forest and nonconventional plants as a source of food in rural areas;

7. creation of agroindustries;

8. application of educational systems in the rural environment;

9. qualitative and quantitative determination of the mechanisms of milk fermentation based on microorganism content;

10. census of common plants in the area under CIIDIR influence;

11. entomological study of the area under CIIDIR influence;

12. use of solar energy in productive goods; and,

13. integral health.

The budget for these 13 research projects of the Durango Unit of CIIDIR-IPN was 4,572,857 pesos for 1980.

With reference to the systematic study of natural resources to apply the scientific and technologic gains to the adequate transformation and utilization of the resources, the National Polytechnic Institute has accepted, since its founding, this challenge. Once again, it renews its willingness to take up, with realism and historic responsibility, the philosophical substance upon which it is based, and rescue it from rhetoric. Our philosophy is to work with a social conscience, a conscience in which the needs of all the Mexicans are those which ask of us as a National institute, "what to do?" If this transcends all areas of human knowledge, it is fundamental in the field of natural resources. It is never too much to ask ourselves once more, "What kind of planet will our offspring inherit?" It is never too much to point out that the conscious, guided transformation of nature can only be attained when the appropriate methods for making scientific postulates a reality exist, when we have dominated it in a positive way, when adequate techniques are applied to the objective conditions which determine nature, and when (at last) we achieve equilibrium between the goals of the productive forces and the truly national interests in the purest sense of the word.

The IPN can and should collaborate in this task. We are not the ones who should put a value on what we have accomplished up to now, our work could prevent us from being objective. We are sure that we are on the right track and are conscious of our limitations as a nation, as an institution, as a group, as technicians, and as human beings. You here will take with you a very general view of our task. Only time can be the final judge of our actions.

Evaluation of Natural Resources Policy Alternatives[1]

G.R. Stairs[2]

The evaluation of policy alternatives presumes a well-defined, "reasonable" set of potential actions from which to make final selection. It also presupposes that agreed upon object functions can be defined and that acceptable policy setting methodology exists. Even these simple requirements are not easily met. For, to look at alternatives, one must acknowledge the viewers biases and also the dynamic nature of man and the biological systems that we will study. Adam Smith, in "The Theory of Moral Sentiments," wrote:

> "The great body of the (discontental) party...are commonly intoxicated with the imaginary beauty of this ideal system, of which they have no experience, but which has been represented to them in all the most dazzling colors in which the eloquence of their leaders could paint it. The leaders themselves, though they may have meant nothing but their own aggrandizement, become, many of them, in time the dupes of their own sophistry, and are as eager for this great reformation as the weakest and foolishest of their followers....
>
> The man of system...seems to imagine that he can arrange the different members of a great society with as much ease as the hand arranges the different pieces upon a chess-board; he does not consider that the pieces upon the chess-board have no principle of motion besides that which the hand impresses upon them; but that, in the great chess-board of human society, every single piece has a principle of motion of its own, altogether different from that which the legislature might choose to impress upon it."

Smith's words reinforce the two issues that deserve our early consideration:

1. the notion that the affecionado's views may not be shared by all; and
2. the concept that both the dynamics of man and (in our case) of ecosystems must be accorded in policy making. We who are enamored about the need for wise management and preservation of ecosystems must recognize that very different alternatives may be viewed as acceptable or desirable by others. While we may, in many instances, have a majority of the people with us, it is, nevertheless, important to begin with a comprehensive evaluation of viewpoints.

Even within the professional groups that will primarily be involved in agenda setting, there is variance in selecting alternatives. In early 1971, a group of American ecologists met to define an agenda for input into the then forthcoming United Nations Conference on the human environment (Stockholm, 1972). Their work was divided into four task groups to study.[3]

1. biogeochemical cycles of elements essential to protein production;
2. ecological constraints on man's use of land, particularly as a result of vegetation-soil interactions;
3. terrestrial food webs, diversity, and stability; and
4. man's impact on aquatic systems, particularly the coastal zone.

They chose to view environmental pollution or degradation as a derivative of resource development and as only one of a number of factors that influence man. While we could find opportunity to discuss much of the technical or scientific information related to our purpose in this meeting under their agenda, I assume that it would not suffice to satisfy all.

The International Union for the Conservation of Nature has more recently put forward views on future needs of mankind *vis a vis* natural systems. A study[4] sponsored by the United Nations Environmental Program (UNEP), together with the World Wildlife Fund (WWF) provides a contemporary "World Conservation Strategy" (WCS). The WCS was prepared by the International Union for Conservation of Nature and Natural Resources (IUCN) in collaboration with the Food and Agriculture Organization of the United Nations (FAO), and the United Nations Educational Scientific and Cultural Organization (UNESCO). The WCS is intended to be carried out by three main groups:

1. government policy makers and their advisors;
2. conservationists and others directly concerned with living resources; and
3. development practioners, including development agencies, industry and commerce, and trade

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[1] Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

[2] Professor and Director, Center for Resource and Environmental Policy Research, Duke University, Durham, North Carolina, USA.

[3] Man in the Living Environment, TIE, Univ. Wisc. Press, 1972.

[4] World Conservation Strategy, IUCN, UNEP, WWF, 1980.

unions. From the executive summary of the WCS, the following six points are obtained:

1. The aim of the World Conservation Strategy is to achieve the three main objectives of living resource conservation:

   a. to maintain essential ecological processes and life-support systems
   b. to preserve genetic diversity
   c. to ensure the sustainable utilization of species and ecosystems

2. These objectives must be achieved as a matter of urgency because:

   a. the planet's capacity to support people is being irreversibly reduced in both developing and developed countries
   b. hundreds of millions of rural people in developing countries, including 500 million malnourished and 800 million destitute, are compelled to destroy the resources necessary to free them from starvation and poverty
   c. the energy, financial and other costs of providing goods and services are growing
   d. the resource base of major industries is shrinking.

3. The main obstacles to achieving conservation are:

   a. the belief that living resource conservation is a limited sector, rather than a process that cuts across and must be considered by all sectors
   b. the consequent failure to integrate conservation with development
   c. a development process that is often inflexible and needlessly destructive
   d. the lack of a capacity to conserve
   e. the lack of support for conservation
   f. the failure to deliver conservation-based development where it is most needed

4. The World Conservation Strategy therefore:

   a. defines living resource conservation and explains its objectives
   b. determines the priority requirements for achieving each of the objectives
   c. proposes national and subnational strategies
   d. recommends anticipatory environmental policies, a cross-sectional conservation policy, and a broader system of national accounting
   e. proposes an integrated method of evaluating land and water resources, supplemented by environmental assessments, as a means of improving environmental planning; and outlines a procedure for the rational allocation of land and water uses
   f. recommends reviews of legislation concerning living resources, suggests general principles for organization within government, and in particular proposes ways of improving the organizational capacities for soil conservation and for the conservation of marine living resources
   g. suggests ways of increasing the number of trained personnel and proposes more management-oriented research and research-oriented management
   h. recommends greater public participation in planning and decision making concerning living resource use and proposes environmental education programs and campaigns to build support for conservation
   i. suggests ways of helping rural communities to conserve their living resources

5. In addition, the Strategy recommends international action to promote, support, and (where necessary) coordinate national action, emphasizing in particular the need for:

   a. stronger, more comprehensive international conservation law and increased development assistance for living resource conservation
   b. international programs to promote the action necessary to conserve tropical forests and drylands, to protect areas essential for the preservation of genetic resources, and to conserve the global "commons" the open ocean, the atmosphere, and Antarctica
   c. regional strategies to advance the conservation of shared living resources, particularly with respect to international river basins and seas

6. The World Conservation Strategy ends by summarizing the main requirements for sustainable development, indicating conservation priorities for the Third Development Decade.

The WCS is a comprehensive statement that provides one means for comparing alternatives against a set of widely agreed upon objectives. It coordinates well with a concept of dynamic or "working" conservation, thus, avoids overfocus on reserves or preserves without losing site of their importance. Nevertheless, as the authors acknowledge in their "Preamble and Guide," "(it) inevitably reflects a compromise among conservationists---and between conservationists and practitioners of development." An important feature of the WCS is the plan to publish a paperback version for the general reader, thus making public awareness a feature of this important effort. For the professional, there are plans to publish a source book, in a number of volumes, over a period of several years.

These examples provide a sampling from a larger set of agendas that coexist (with some agreement and some disparity). A further measure of hetereogeneity can be added by examining the mythology of "conventional wisdom." For example, it is often assumed that developing countries have predominately unspoiled, virgin territory and, thus, have less need for national parks and preserves. In the developed countries, with advanced agricultural and resource technology it is often assumed that matters of soil and resource conservation are totally resolved and that losses to ero-

sion are minimal or nonexistent. Similarly, one may hear that "developing countries do not have an interest in environmental pollution or resource preservation, since their need is more immediate and related to economic development." These, and other false statements, remind us that the world cannot be treated in generalities or as an undifferentiated whole; there must be geographic reference and specificity in choosing resource policy alternatives.

Even generally agreed upon alternatives may provide disparate results when implemented in different ecosystems. For example, the influence from environmental concern about DDT moved rapidly around the world in the 1960's. In Sri Lanka, the government banned DDT, only to see the number of deaths from malaria increase from nearly zero in 1961 to more than 10,000 in 1968. Such irony can result from blindly choosing alternatives that are effective or desirable in one area, but that may not be so in another. In the Sri Lanka example, there was a clear need for substitution to maintain the malaria control program as DDT was phased out.

Development usually provides both opportunity and need to increase effective natural resource policy setting. It is interesting to consider that for many regions, an improvement in the environment can only come from development or other exogenous input. Miguel Ozario de Almeida of Brazil has said[5] "...given appropriate space and time the environment will be able to cope with foreign matter injected into it; and they (economic and environmental problems) tend to diminish with economic development itself, contrary to the prevailing conditions in developed countries. In fact, it is impossible to correct this process of pollution without development, in part because one of the very definitions of development consists in not having this type of pollution, and in part because the resources necessary to cope with it are not available to low levels of income." An analogy to land use policy could call for alternatives that insist upon the maintenance and improvement of preserve or reserve areas as a condition for development and improvement of the managed ecosystems for agriculture, grazing, or forestry. Such a linkage would require definition of the desired balance for land use in a comprehensive manner and would attach financial support for reserves as a condition to total land use development.

The question of agenda setting could, of course, be extended to much more specific items. The discussion of such items I will leave to the sector papers presented at this meeting and to our audience interaction. Rather than relate to specific alternatives in a given region, I feel more obligated to focus our attention on the methodology of policy setting and, in particular, upon the politics of planning and quantification techniques. I do so with some confidence that a policy-making methodology, to which no one pays attention, is not what we need. Nor do we wish to establish adversary relations between various planning technocrats at natural resource or other sector levels. We may also note that policy making will range from an ad hoc process, decentralized at local levels to more comprehensive, central planning systems. While seemingly self-evident, it is, nonetheless, important that resource-policy methodology pay formal attention to local decentralized inputs. Alternatives can only be normalized for appropriate ecosystem responses at the decentralized level. Conversely, it is a mistake to attempt a policy definition at local levels that cannot be related to national or regional state planning and policy. Thus one might suggest that contemporary policy making requires a dialogue at all levels by "all concerned parties." In so doing, the original alternatives slate may be kept intact, added to, or modified for final agenda shaping. After all public and private inputs are received, final selection and evaluation of alternatives is more easily accomplished.

The dynamics of policy methodology places heavy emphasis upon knowledge and information systems, and must also recognize the limitations therein. It is important to select policy alternatives that address the need for continued inputs from research and information systems. The type of information we seek will allow a view of trade-offs involved in selecting various alternatives. To efficiently utilize the information, we require a methodology that will assure a comprehensive systems approach. The availability of contemporary, computer based systems analysis methods suggests these as useful to our purpose. An example of simulation techniques is presented elsewhere in the program by Rasmussen and Ffolliott; in this paper, I will only comment briefly on policy related to the technique. The advantages of simulation are obvious and, dependent upon the technique, provide a useful means for quantification of symbolic logic and for assuring that data are scale-compatible. The further advantage of rapidly estimating optimality over a range of alternatives is clear. However, the acceptance, both initially and finally, for such techniques will continue to rest upon verification. The development of time-series data should be a constant part of systems analysis policy.

Information retrieval technology has developed at a rapid pace during the past decade. Progress has been made in terms of information input and in the format and manipulation ability of advanced computer graphics. Advanced techniques of remote sensing join satellite imagery with conventional aerial photography and ground truth to provide new accuracy in resources assessment. Simulation techniques can be used to further relate observed data to complex and dynamic systems, and to, thus, enhance the efficiency of alternatives evaluation.

In summary, I have suggested that evaluation of resource policy alternatives may begin by developing accurate data bases and, then, quantitatively evaluating the data through systems and simulation models as a necessary prelude to the policy phase. It is at the interface between quantification and more integrated socioeconomic decisions that major

[5]Development Digest, II; April 1972; p.23.

opportunity is provided to define policy alternatives for presentation to the public and their elected officials. Maintaining a view of resource policy agendas (put forth on a global basis or in other nations) can also be of great help. Comparison between local or national goals and those sought by others in a similar situation helps to assure efficiency and state-of-art decision making.

The setting of policy alternatives is a formidable task indeed, but one that must be pursued with great vigor, if we are to succeed in meeting our professional objectives. To that end, I suggest that sharing technology and methodology for selecting alternative policies can be of most immediate value. In so doing, we need not forego the traditional sharing of scientific information related to biological, physical, or ecological systems. It is, however, important to recognize that choosing effective policy alternatives requires aggregation into well-defined systems analysis and that new approaches and techniques are under dynamic development. Once we have assumed that the task is as complete as possible at the natural resources level, we can begin the work of relating to cultural, social, and behavioral aspects. Only then, can we assume that our professional efforts have been placed into compliance with Adam Smith's suggestion that "in the great chess-board of human society, every single piece has a principle motion of its own, altogether different from that which the legislature might choose to impress upon it."

Simulation of Consequences of Implementing Alternative Natural Resources Policies[1]

William O. Rasmussen and Peter F. Ffolliott[2]

INTRODUCTION

Simulation techniques are often used to reproduce the behavior of biophysical systems in the form of a model that closely represents real life. Through simulation, appropriate models can be operated to obtain alternative solutions to land management problems. Simulation techniques do not necessarily generate optimal solutions; rather, they show alternative results that allow an investigator to make the best decisions for a given purpose. Commonly, simulation exercises are carried out on digital computers, since these exercises usually require many calculations. However, simpler simulation exercises can be executed without computers.

Through the application of computerized simulation techniques, it is possible to analyze consequences of implementing alternative natural resources policies, and then select the best course of action from these alternatives. In essence, alternative policies are translated into land management scenarios; these scenarios are then structured into simulation exercises. By obtaining solutions to the simulation exercises and comparing the respective outputs with social and environmental acceptance criteria, natural resources policies that meet desired land management goals may be recognized.

Many computerized simulation techniques are currently available to analyze the impacts of land management practices on an ecosystem. In particular, a group of interactive computer simulation models has been developed to aid natural resources policy makers estimate consequences of implementing alternative policies. This group includes modules that address the following topics: growth and yield of forest overstories; production of herbaceous understories; animal carrying capacities; and wildlife habitat assessments. Briefly, these modules are described herein, and an example of their use in analyzing alternative policies is presented.

GROWTH AND YIELD OF FOREST OVERSTORIES

Simulators designed to estimate the growth and yield of forest overstories fall into two categories: models that are broadly structured to represent a variety of tree species and models that are specifically structured to represent a particular tree species.

An example of a computerized simulation technique in the first category is called STAND. By design, STAND is structured to estimate the growth and yield of forest stands comprised of a single tree species or a mixture of tree species, through stand projection methods applicable to uneven-aged forest stands.

The simulation objective of STAND is to predict the growth (both gross and net) and yield of forest stands prior to and, if appropriate, following the implementation of various land management practices. Inputs to this modular component include a listing of trees per hectare by size class, and associated diameter growth rates and volume expressions. As management is prescribed to change these inputs, posttreatment growth and yield are interactively generated. Silvicultural management practices that can be simulated within STAND represent an array of viable options for the different forest stand compositions being considered.

Outputs derived from STAND, including summaries of basal area levels through time prior to and following a management redirection, are readily used by other modular components. As the manipulation of forest overstories is a primary management activity affecting many aspects of an ecosystem, such interfaces among modular components are critical to realistic simulation of an ecosystem's overall behavior.

PRODUCTION OF HERBACEOUS UNDERSTORIES

A computer simulator has been structured to estimate herbage (all understory species) production from knowledge of forest overstory parameters, precipitation amount, and if appropriate, time since the implementation of a land management practice. Depending upon the particular simulation objective, a user may operate this component, called UNDER, individually or in conjunction with another model. In the latter instance, outputs from other modular components in the group are utilized as inputs.

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[1]Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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Many of the previous attempts at developing computer simulation techniques to estimate herbage production have been dependent, primarily, on input variables depicting forest density conditions. While this approach remains viable and has been utilized in UNDER, the herbage production simulator also utilizes knowledge of forest overstory growth. Estimates of herbage production that are based on knowledge of this variable appear consistently of higher precision than those based on knowledge of forest density alone.

UNDER partitions simulated herbage production into three categories: grasses and grasslike plants, forbs and half-shrubs, and shrubs.

ANIMAL CARRYING CAPACITIES

In the modular component structured to predict animal carrying capacity, referred to as CARRY, herbage production (entered as a direct input by the user or obtained from the herbage production simulator) is partitioned into usable forage for domestic livestock or wildlife species. Appropriate plant species to include in each forage component were ascertained from existing literature relevant to the preferred foods for these animals, along with information about appropriate or proper utilization percentages. The amount of usable forage required per animal unit month (AUM) for the animal species being considered is input directly by the user.

It has been assumed that the proper use factors to be applied in CARRY will be introduced by the user in an attempt to meet specific management objectives. It may be necessary, for example, to reduce a proper use factor on a particular range that has been subjected to prolonged overgrazing pressures. As baseline information relating to proper use factors increases, the ability to predict carrying capacities will improve accordingly.

With respect to the number of months that domestic livestock and wildlife species will actually be consuming forage on any tract of rangeland, this value is quite variable depending, in part, upon weather factors (time of snowfall in the autumn, time of snowpack disappearance in the spring, etc.). At best, only estimates based on local knowledge of average situations in the long run can be made. However, to provide a point-of-departure in utilizing CARRY, specific forage consumption time durations have been selected. It should be emphasized that the user can readily override these default duration values to more accurately reflect local conditions, if better information is available.

At this time, realtively little can be said about possible constraints that may affect the distribution of animals that are considered by CARRY. While it is known that various factors may restrict (or at least modify) animal movement, explicit identification and subsequent quantification are currently difficult. Conceivably, portions of a tract may be eliminated from use because of movement constraints (physiography, fences, etc.), which may necessitate appropriate reductions in animal stocking rates.

WILDLIFE HABITAT ASSESSMENTS

Simulators that assess habitat quality fall into two categories: models broadly structured to represent a variety of animal species (including game, nongame, and domestic) and models specifically structured to represent a particular animal species.

An example of a modular component in the first category is HABRAN (HABitat RANking). In essence, this component synthesizes ranked response predictions which, in turn, can be summarized and arrayed as pattern recognition models. Within HABRAN, animal habitats are assigned numerical values ranging from 0 to 10, with habitat quality in an ecosystem increasing with numerical value. The specific assignment of these values is achieved through analyses of functions that relate habitat preference to readily available inventory-prediction parameters, the magnitude of which are altered by alternative land management practices. By comparing numerical habitat quality values for existing conditions with those predicted for habitats modified by management redirection, either an increase (+), a decrease (-), or no change (0) is determined. Then, a matrix of pluses, minuses and zeroes arrayed for all animal habitats and management alternatives of interest (by definition, a pattern recognition model) can be displayed to provide insight into comparative management impacts.

The HABRAN component is, in a sense, a first-level-of-interest assessment of the impacts of alternative land management practices. In many instances, this sort of analysis may be all that is required. However, if estimates of carrying capacities and animal distributions are needed, other modular components may be called into play.

EXAMPLE OF SIMULATION

Perhaps the best way to illustrate the use of simulation techniques to analyze consequences of implementing alternative natural resources policies is through an example. For illustration, four policies will be considered for possible implementation in a montane forest ecosystem on a biosphere reserve, and the best course of action will be selected from these alternatives. While all of the policies under consideration stress enhancement or (as a minimum) maintenance of natural resource production, different resource products are emphasized.

One policy states that existing carrying capacity for domestic livestock (in specific, for cattle) will be increased, while maintaining (or enhancing) forest growth and yield and wildlife habitat quality (in this example, deer habitat).

Two policies require an increase in growth and yield of forest overstories by encouraging (in one case) an uneven-aged forest structure of (in the other case) an even-aged forest structure. As part of these policies, maintenance (or enhancement) of carrying capacity for cattle and deer habitat quality will also be required. The final policy under consideration is to retain the current land management system, that is, to allow things to remain as they are.

By adopting a policy to increase existing carrying capacity for cattle, forest overstories on moist sites (one third of the area, adjacent to drainage) will be converted to grass. Through silvicultural treatments, forest growth and yield on residual sites should be increased, attempting to maintain growth and yield overall. Conversion of moist sites to grass should enhance deer habitat quality by increasing food and improving habitat diversity.

Intensified silviculture will be prescribed to increased growth and yield of forest overstories, a requirement in two of the policies. A group selection treatment (involving a reduction of 25 percent in forest density) will be followed if an uneven-aged forest structure is the policy. Under a policy of even-aged forest structure, a shelterwood treatment (in which the forest is gradually removed in a series of partial harvestings) will be imposed. Carrying capacity for cattle should be increased in both cases, as a reduction in forest density usually increases grass production. Deer habitat quality should be enhanced under both policies.

Current land management is assumed to be a form of group selection, but less intensive than would be required under a policy of an uneven-aged forest structure. With this management, production levels for all natural resources remain unchanged. However, as costs of implementing a new policy would not be incurred, benefit-cost relationships may be more attractive than investing in a management redirection. From a simulation viewpoint, it is important to include the current situation in a simulation of consequences to furnish a basis for analyzing possible change.

Using the group of interactive computer simulation models described above to estimate consequences of implementing the hypothetical policies, the following output was obtained:

Item	T_0	T_1	T_2	T_3
	As is	Convert	Uneven-aged	Even-aged
Forest growth (cu. m/hectare)	4.2	2.5	5.5	5.2
Forest yield (cu. m/hectare)	4.4	3.9	4.9	3.8
Carrying capacity (cattle) (animal units)	13.2	27.4	17.2	19.3
Wildlife habitat (deer) (quality value)	6.7	+	0	+

At this point, a decision must be made as to the best course of action in selecting a policy for implementation. While other social and environmental consequences not included in this example (impacts on other natural resources, costs of implementation, etc.) should be examined in the decision process, for purposes of illustration, only those consequences estimated above will be considered.

With respect to a conversion policy, T_1, carrying capacity for cattle is predicted to double, and deer habitat should be enhanced. However, the silvicultural treatments to be imposed on residual sites will apparently not maintain forest growth and yield overall. Therefore, a decision not to implement this policy seems appropriate.

The policies of increasing forest growth and yield through intensified silviculture are predicted to meet acceptance criteria regarding these parameters. A policy of uneven-aged forest structure, T_2, should provide a higher level of forest growth and yield than a policy of even-aged forest structure, T_3. However, carrying capacity for cattle is predicted to be greater under an even-aged forest structure, and deer habitat quality should also be enhanced with the latter policy. Therefore, a trade-off analysis may have to be made to determine which, if either, of these policies should be implemented. While simulation techniques (such as those employed in this example) may furnish input to a trade-off analysis, decisions as to policy implementation are also based, in large part, on professional judgements constrained by inherent natural resources productivity and long-term utilization goals relative to these resources.

A decision to retain the current land management system, T_0, is certainly a valid option. Such a choice may be made if, for example, costs incurred to implement any of the other policies are excessive.

In the final analysis, while additional information may be required to select the best policy for implementation, computerized simulation techniques may be useful in analyzing consequences of implementing the alternative policies under consideration. However, these simulation techniques will not necessarily generate optimal solutions. Instead, through simulation, impacts of alternative courses of action may be predicted and provide input to making a decision regarding policy implementation.

Land Use Planning in the United States[1]

M. Rupert Cutler[2]

It is not often necessary to allocate many individual tracts of land to the extremes of either complete preservation or intensive development. Biosphere Reserves and wilderness areas are essential and valuable to science and to society at large. I make this point in my paper, "Wilderness Decisions: Values and Challenges to Science," which appeared in the February 1980 issue of the Journal of Forestry; but, I would like to emphasize the point that the majority of the world's landscape, not so preserved, can be managed so that the environment is protected, public opinion regarding management objectives is respected, and the food, fiber, forage, and forest products required by society are produced from the land economically.

In the United States, one third of the land is administered by public agencies such as the Forest Service of the Department of Agriculture and the Bureau of Land Management and the National Park Service of the Department of the Interior. Two thirds of the land in the United States is owned by private individuals and corporations. Most of this private land is divided into relatively small, family-owned and operated farms and ranches. Our farmers and ranchers like to describe themselves as free private enterprise capitalists, but they are constrained, as well as assisted, by government in many ways; we do not have an unconstrained laissez faire system today, although one did exist in our country in the 19th Century.

In the next few minutes, I will summarize the institutional mechanisms available to policymakers in the United States to influence land and resource use on both public and private lands in our country.

This review of what is in place in the United States today(i.e., the means now available to us to improve land use and, thereby, improve our people's quality of life) may complement yesterday's presentations which emphasized more ideal processes which involve the use of data, computer models and public consensus that have not yet been perfected.

All public land in the United States is undergoing a new round of comprehensive land and resource management planning. The key Federal statutes requiring the preparation of these management plans are:

1. the Forest and Rangeland Renewable Resources Planning Act of 1976 and
2. the Federal Land Planning and Management Act of 1976.

These laws require adoption of new, multiresource plans for every one of our 154 National Forests by the year 1985, and require that a similar process be carried out on the public rangeland administered by the Bureau of Land Management.

How this planning is done is directed, in part, by other statutes, including:

1. the Wilderness Act;
2. the National Environmental Policy Act; and
3. the Freedom of Information Act.

These laws provide direction to protect wilderness values, where they still exist, consider an array of practical alternative plans and their impacts on the environment, and expose these alternatives to public review and comment prior to adoption of any one of them. Administrative appeals and judicial review are provided for also.

The most important aspect of this new public land planning process, covering some 350 million hectares of land, is the use of interdisciplinary planning teams, which include biologists, sociologists, economists, and landscape architects. Such teams are being used on each National Forest and Bureau of Land Management district, to assure that fish and wildlife habitats, archeological values, aesthetics, water quality, recreational opportunities, and local economic impacts are considered, while sustainable production of raw materials needed by society is provided for, to the extent such production is compatible with the protection of long-term productivity.

Truly, multiple-use management of the public lands in the United States has come of age; it is no longer a "cover" for timber management or an overemphasis on grazing, but is an increasingly sophisticated process providing something for all users, urban and rural, where possible, taking advantage of opportunities to produce and conserve simultaneously. This is not to say that all plans being produced today are excellent plans, but the current process is a vast improvement over its predecessors.

On the 700 million hectares of private lands in the United States, landowners choose their own objectives and pursue the profitable production

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[1]Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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of food crops, livestock, timber, and other commodities, while behaving as good neighbors from the standpoint of the environmental impact of their activities. They must behave reasonably well, because their neighbors can sue them in court if they create a nuisance, and Federal laws administered by the States require the maintenance of air and water quality standards.

Millions of land-owning farmers and ranchers in the United States have detailed conservation plans for their lands, prepared for them (free of charge) by local technicians, called district conservationists, employed by the Soil Conservation Service of the Department of Agriculture. The cost of installing the soil and water conservation practices, wildlife habitat improvement, and woodlot management techniques prescribed in the conservation plan is shared with the landowner by the Department's Agricultural Stabilization and Conservation Service; the Federal government pays half the cost of approved practices. The Cooperative Extension Service at each State landgrant university sends results of agronomic and forestry research to the farmers to teach them how to produce profitable crops while protecting the environment. The Farmers Home Administration of our Department loans money to farmers at subsidized low interest rates to help them make the necessary capital investments to get started in farming and to recover from emergencies. Price supports are established to guarantee a minimum price on certain crops.

Thus, our government assists our farmers, ranchers, and woodlot owners in many ways to assure their well-being. This, in turn, helps assure both production and conservation. Currently, our government is giving renewed attention to soil and water conservation policies and practices on private land. The Soil and Water Resources Conservation Act of 1977 directed the United States Department of Agriculture to assess the condition of our Nation's soil and water resources, to document the need for conservation practices, and to devise appropriate strategies to implement these practices. Under the leadership of the Soil Conservation Service, this appraisal and policy development process requires extensive public participation and will culminate in major recommendations to the President and the Congress. The result of all this decentralized, mainly voluntary action, at the local level under uniform federal guidelines, is that much of our United States landscape already has been planned from a conservation standpoint, and is being operated both to provide the products and services which society needs from the land, for food, clothing and shelter, and to protect the environment.

In summary, a nation does not need to wait until it has an ideal national plan to make important progress toward sound resource management and conservation goals.

Obviously, each country has its own tradition within which its citizens must work, the answer as to the best process will differ from country to country.

But in every country, there are knowledgeable persons in local areas (farmers, businessmen, teachers, university and government scientists, and private and public decisionmakers) who can proceed to develop appropriate local conservation and rural development recommendations and perhaps assume local support for implementation of plans.

I urge you to become catalysts, to encourage people to address this subject, and to give local planners your confidence, support, and economic incentives where you can, so that some incremental progress can be made immediately, rather than waiting for the perfect process, which will produce the perfect plan.

Perhaps we are wrong in the United States for "shying away" from "national planning." It may come someday, but our people will not accept it now. However, much good work is being accomplished under that title on the decentralized basis I have described, and we are trying to improve the process as we use it.

The Real World of Policy Making and Decisions[1]

Robert L. Herbst[2]

Since this seminar is an exchange of communications between scientists and policy makers, and since the papers presented have been directed at facts, scientists should know concerns policy makers have, and what policies should be. Those of us at a policy level should share the "real world of policy making and decisions" with you. This is what I intend to do. While the system may be different in your country, the responsibilities and problems are similar.

In the United States, broad national policy is considered and determined at three levels of the Federal government. The Legislative branch establishes broad policy by legislation in response to societal interests; the Executive branch carries out and administers policy, and has authority to make additional policy within the framework established by Congress; and the Judicial branch examines the legality of policy, and enforces it.

As a representative of the President and Executive Branch, I am the administrator of three large Federal bureaus--National Park Service, Fish and Wildlife Service, and Heritage Conservation and Recreation Service. Let me describe my personal decision-making environment as an example. I was selected for the position by the President and by the Senate, therefore, it is a political appointment, but since the title was created by stature to include "Fish and Wildlife" it presumes a qualification by education and experience. I have background experience of 27 years, which includes education as a wildlife manager and forester, teaching, public relations, and an administrator of 17 years.

Let me briefly explain my job. I administer over 80 million acres of national parks, parkways, historic sites, monuments, and cultural centers; 83 million acres of wildlife refuges; 97 fish hatcheries; schools, training and research centers, wild and scenic rivers, and trails of all types. Programs include fishery management, wildlife management, historic preservation, outdoor recreation, a number of grant programs, archaeology, endangered species of flora and fauna, ecological and biological reserach, regulatory authority over adverse effects to the environment, and so forth. My three agencies include as many as 35,000 employees, a budget of as much as $2.8 billion a year, and enumerable buildings, planes, cars, trucks, and other types of equipment.

I also chair or serve on approximately 10 Presidential Commissions, including Vice Chairman of the Great Lakes Fishery Commission, United States Commission to UNESCO, member of the President's Interagency Council, and Chairman of the Migratory Bird Commission. From this brief description you can get a feel for the magnitude and diversity of responsibility. As an administrator, the job includes supervision of the three agencies; personnel management and selection; budgeting; legislative efforts; education and informing; communication; issue resolution; management improvements; decisions of all types; the development of new programs; selling to Congress and the public the President's ideas on programs and the related finance and manpower needs; and international negotiations and administration of approximately 40 multilateral and bilateral treaties.

The role of an administrator is a complex and busy one that requires scientific facts, philosophical ideas, legal advice, economic information, and public opinion and involvement in order to make a decision. The most difficult and frustrating need of an administrator is time. Therefore, he must have complete confidence in his staff and outside information, because decision making on issues covers a short time span.

When I must make a decision on an issue, I direct my staff to quickly outline the issue, document it, give me the alternatives for solving it--the pros and cons of each alternative--recommendations and why; then a decision is made, and we go on to the next issue.

I can make no decision without the scientist (I can, but there would be many mistakes if I did). It is important that I have the scientific facts. And the scientist needs the decision maker or his work results in no action. We both need society's support or we both don't exist. But more important, the care and condition of our natural resources would decline rapidly, as would the quality of life.

Simply stated, an administrator must do three things:

1. plan;
2. do; and
3. evaluate - the same three things in all of life.

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[1] Paper presented at an International Seminar on SOCIAL AND ENVIRONMENTAL CONSEQUENCES OF NATURAL RESOURCES POLICIES, WITH SPECIAL EMPHASIS ON BIOSPHERE RESERVES, held in Durango, Durango, Mexico, April 8-13, 1980.

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Public policy is referred to by some as the "art of the impossible," but really it is a changing, dynamic, posture at any given time. It is not made in reality by one person but by the public at large. The role of the decision maker is to face the diverse pressure of facts, law, and opinion, make a decision, and carry it out. In my department we weigh development and protection equally, but if an impasse occurs we decide on the side of conservation. Why? Because it is easier to redo a decision than undue a failure.

What we need from the scientist are reliable facts; timely, precise responses to requests for information; the separation of hard data from opinion; clear recommendations we don't have to hunt for; and an understanding attitude when decisions don't exactly fit his input and advice.

You need from us clear instructions when requested; the hypotheses involved as we see them for starters; discussion of priorities; and use of effort. We are all scientists, philosophers, and decision makers to varying extents; we are all a part of society as a whole. We must work cooperatively because we are in the boat together in the waters of life. We sink or swim together as does the future of mankind.

My philosophy has been these words: Your Creator has created all things necessary to sustain you and found them to be good. While you dwell among the mortals you may partake. Use them wisely and judiciously. Guard them closely, squander them not. For if you are untrue to this sacred trust, mankind shall not be perpetuated, but shall perish from this Earth.

In conclusion, the role of the administrator is a lonely one, a tense one, a frantic one, and one in which you lose friends with every decision. But, it is an extremely gratifying challenge to serve mankind.

Abraham Lincoln said it well when he said, "If when my time comes to lay down the reins of power I shall have lost every friend on earth save one - the one deep down inside of me - I will then have done my job well."

Nature Reserves and Conservation in Central America[1]

Jaime Incer[2]

The isthmus occupied by Panama and Central America serves, we all know, as a bridge or transition zone between the flora and fauna of North and South America. This transition can be seen throughout the length of the isthmus, as well as in its altitudinal zones. The area also contains several endemic species which evolved in specific local environments; these are residual populations with paleoecological ancestors and are confined by geographical barriers, altitudinal isolation, etc. (fig. 1).

The high biologic potential of Central America is exhibited in the humid montane, premontane, and tropical forests along the Carribean slope, where the humid eastern winds blow from sea level up through the ecological zones to the highest peaks of the central mountains, which form the back bone of the isthmus.

The importance of these life zones lies not only in their species diversity, but also in their wide areal extent, especially those that cover the wide plains of humid Carribean slope.

However, all of the Central American countries except El Salvador which does not have a Carribean slope, are suffering from a rapid migration of the population from the Pacific regions to the Carribean. The continuing colonization of this region is slowly reducing the natural vegetation to an alarming extent (fig. 2). To give an example, it was estimated thirty years ago that 60 percent of the Nicaraguan land (mostly situated along the Carribean slope) was covered by tropical rain forests. Today, this has been reduced to a little less than half.

Some of the causes for this grádual reduction of the tropical rain forests in Central America are as follows:

1. the expansion of agricultural lands toward the Carribean Sea through spontaneous colonization. Since this takes place in an irregular and uncontrolled manner, large virgin tracts of tropical forests are sacrificed through slash and burn agriculture.

2. precarism or the illegal possession and use of isolated and remote lands under state control. The precarists clearcut forests without even making use of its resources. Once the wood is burned and the land cleared, the land is sold to people with agricultural interests.

Figure 1.--Sumu Indian hunting "kakamukas" (iguanas) along rain forest river banks in Nicaragua.

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Figure 2.--Rain forest along Waspuk River in north-central Nicaragua.

3. authorized colonization by entire families, generally forced from the marginally productive Pacific lands to the humid Carribean slope where, once settled, they cut the forests and start subsistence farms, hoping for a limited, but ephemeral yield. After a few years, production falls due to depletion and erosion of the soil, forcing the farmers to open new lands, progressively destroying more virgin soil. This type of colonization is generally the result of a national development policy based on agriculture and instigated by the use of so-called "roots of penetration into the forest," under the pretext of increasing agricultural production and stimulating regional economic development. This policy does not take into account the ecological role played by the tropical soils, or is it conscious of the fact that it is contrary to any sustained agricultural development in regions whose lateritic soils have been depleted of their soluble minerals by the frequent rains, which exceed two meters a year.

4. logging, which contributes to the humid tropical forests. This exploitation throughout all of Central America is based primarily on short-term profit, without providing integrated management and recuperation programs for those broad-leafed hardwood forests.

Roads cut into the forest by logging companies are later invaded by precarists and slash and burn farmers who further contribute to the irreversible destruction of the forest. The natural ecologic succession of the forest is, thus, ended through years of cutting and burning for the purpose of obtaining new lands of little agricultural value or more extensive range lands.

In this way, we can explain how the vast pristine broad-leafed hardwood forests (which covered extensive areas of the Carribean slope of Central America) have been irreversibly disappearing, now reduced to isolated disconnected patches. Even in the largest countries of the area, Guatemala, Honduras, and Nicaragua, there are no longer intact areas larger than 10,000 square kilometers which can be managed as true representative natural reserves of humid tropical forests. Even within the reserves that exist, especially along the deep rivers that penetrate them, there are already settlements taking advantage of the alluvial soils to plant plantain, corn, beans, and other subsistence crops. That romantic vision of ancient wild trees whose branches form literal tunnels along the rivers is, every day, more a thing of the past.

I believe that, on a public level, there is now some understanding of the problem, in spite of the fact that there still are some planners who consider the tropical forests an obstacle to development instead of an aid. That concept of development which implements agricultural cultivation of forest lands, accompained by agricultural colonization of the Carribean slope, forms part of the economic programs of all of these countries. Ecological considerations do not carry enough wieght to be taken into account. It would be advantageous, in light of these facts, to delimitate as a preventive measure, some of the representative areas of natural tropical wet forests, montane and premontane, as large natural reserves or Biosphere Reserves. The establishment of watershed management programs for hydroelectric power could be a convincing argument in those mountainous countries with energy proglems.

The ecological impact of those works would be less than those of future agricultural or logging ventures.

Also, I believe that we cannot wait for these countries to gain an adequate level of ecological consciousness before trying to solve these problems of development. I think that, as ecologists, our arguments may seem a little academic. We need to find tangible economic arguments to demonstrate the advantages of conservation of the tropical rain forests of Central America. We hope that the congresses and seminars on this subject will adopt reasonable recommendations or resolutions to submit to the governments of these countries, and that not only conservationists and ecologists participate in those reunions, but those who plan and direct the territorial development programs as well. We also hope that the international development agencies take note of these arguments and adjust their economic and technical aid accordingly to achieve a higher ecological consciousness in the policies of these impulsive countries, without forgetting that, in this narrow Central America isthmus, there are now 18 million inhabitants in search of new horizons and frontiers.

Management of a Tropical Forest[1]

Frank H. Wadsworth[2]

We have been discussing Biosphere Reserves as if their only objectives were the preservation of germplasm, ecological research, and education. An equally important objective listed by MAB is the conservation of diversity. This does not mean only in the ecological sense. It involves the integration and management together of diverse land uses. This process of management is, of itself, complex and vital to the accomplishment of the other objectives that concern us.

A Biosphere Reserve, not entirely unlike La Michilia in Durango, the Luquillo Experimental Forest in Puerto Rico, is under management for diverse purposes. The total area, some 11,200 ha, is altogether forested, but only 55 percent of it is primary. Of the primary forest, some 92 percent is designated to continue to remain unmodified. About a quarter of this is reserved in two research natural areas, to be used only for non destructive investigations: within these two areas are 4 life zones, 4 ecosystems, 60 endemic species of trees, two endemic amphibians, and one endemic bird.

Another third of the primary forest is designated for wilderness, and for recreational use. Neither of these uses is to be permitted to modify any significant forest area. Another third is reserved for watershed protection.

Recreational development, supporting about 1,500,000 annual visits, includes roads, trails, observation towers, and picnic areas. A 7-day-a-week visitor information service serves a continuous flow of school students, as well as tourists and other visitors.

Research and demonstration of timber production is in progress on 25 percent of the reserve, nearly all of it is secondary forest. About 30 percent of the area is subject to improvement of the native forest, the rest being enriched by underplanting. Both research and demonstration are conducted on this area.

The forest as a whole is a source of local pride. There is no pressure to stop or modify the management program.

Dr. Halffter's questions, asked earlier in the seminar, presented philosophically to us to arouse our thinking, seem worthy of comment. One, concerned with what he referred to as an "ambiguous land ownership pattern" in parts of Mexico, appears to present no insurmountable problem in resource protection and conservation elsewhere. Certainly there must be ejidos receptive to well presented technical counsel.

A second question raised by Dr. Halffter was whether conservation should even be attempted at a time when demands for development are so intense. The answer to this appears to lie in the improbability that the present intensity of demands will ever let up. It is this very intensity that makes action now all the more urgent. Even if adverse aspects of development can only be slightly ameliorated at present, a continuous effort in this direction is needed until sufficient public support is generated to meet issues of environmental significance head on and produce an improving rather than a deteriorating environment.

Dr. Halffter also expressed doubt as to the merits of local work such as that which might be done in Biosphere Reserves or the use of Dr. Gomez Pompas land use classification system unless it led to revised national policies. Yet this seminar has recognized a serious disparity between proclaimed national policies and practices on the ground. For this very reason, local examples of excellence appear to be a thoroughly adequate goal for the present. National adoption, if and when it comes, may well be the work of nonscientific components of society.

The presence of many young people in this seminar is encouraging, and especially that of officials concerned with public education. As environmental problems continue to grow, increasing support for change can be expected. When this time comes it will be important that the young generations carry part of the responsibility. These people are now students in the public schools. They must all be made aware of environmental values and problems. It will not, however, be necessary that they all become experts in order to shift public opinion toward better environmental management.

One or two participants referred to the need to develop land use practices without the importation of nutrients (application of inorganic fertilizers). We seem to need clarification of the implicit debt contracted when nutrients are exported through the harvest of crops, and the

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prospect that fallow periods (long enough to compensate the system) may be incompatible with production requirements. Mexico has announced plans to build a fertilizer plant with a capacity adequate to supply each farmed hectare with something like 300 kilos of fertilizer each year. It is to be hoped that fertilizer trials can be conducted on degraded management soils. In some areas even a light application can double yields, and presumably reduce farmland requirements accordingly. This could reduce or at least postpone pressures on lands that might better be left in forest.

We have been told that Mexico's tropical high forest area has been drastically reduced. What is left, because it is unique, is probably as valuable as all former forests were, and deserves special conservation efforts. The concern for loss of species might well be concentrated in part on saving a good system of secondary forests, since these probably contain most of the species of the former primary forests. Results in Puerto Rico suggest that the loss in species may not be proportionate to that of primary forest area if a network of secondary forests can be saved.

Visits to Mapimi and La Michilia Biosphere Reserves[1]

Gonzalo Halffter, Peter F. Ffolliott, and Warren P. Clary[2]

As mentioned in the Preface to these proceedings, this seminar placed special emphasis on the consideration of natural resources policies that can impact Biosphere Reserves. By definition, Biosphere Reserves are areas of land designated by the Man and the Biosphere (MAB) Program to form a basis, within the natural and social sciences, for rational use and conservation of that portion of the earth's crust and lower atmosphere which contains life. Of particular interest to the participants at the seminar, was policies affecting those parts of Biosphere Reserves that are subject to manipulation by man. It is from these areas that people living on or adjacent to Biosphere Reserves commonly derive a variety of products and uses. Many of these people are entirely dependent on Biosphere Reserves for their livlihood and natural resources policies affecting Biosphere Reserves are of extreme importance to them.

Upon the completion of the formal and informal discussions which formed the core of the seminar, participants visited Mapimi and La Michilia Biosphere Reserves in the State of Durango, Mexico, to observe in-situ social and environmental consequences of natural resources policies imposed on these areas. Unfortunately, it was not possible for the participants to visit both of the Biosphere Reserves. Therefore, this summary has been prepared to highlight the visits.

MAPIMI BIOSPHERE RESERVE

The Mapimi Biosphere Reserve is situated northeast of the town of Ceballos, Durango, in the point formed by the boundaries of the States of Durango, Chihuahua, and Coahuila. The Reserve lies in a basin surrounded by small mountain ranges in a large catchment area known as Bolson de Mapimi. No legal boundaries have been fixed for the Reserve, but work has begun on a area of 20,000 hectares, regarded as the core zone, surrounded by a large buffer area. An association has been formed under the authority of the Government of the State of Durango and the scientific direction of the Institute of Ecology to regulate the Reserve. It comprises the public authorities and graziers in the area and appropriate federal authorities. The region has had little disturbance except for sporadic hunting and, to a lesser degree, extensive stock raising. For the time being, all hunting has been voluntarily suspended, especially that of the desert tortoise. The peasants supervise observance of this ban.

The Mapimi Reserve is a part of the Chihuahuan arid zone. Microphyllous shrub species provide its character. Creosotebush is the characteristic plant determining the general physiognomy of the area, together with fleshy leaved or thick-stemmed species, and large expanses of tobosa grass. Noteworthy fauna include the mule deer, giant tortoise (a species in danger of extinction), coyote, lynx, and puma.

The predominant physical features include alluvial deposits of recent Pleistocene materials and outcrops of igneous rock from the Tertiary period. There are isolated mountains, extensive interconnected plains, and a spring in the core zone. Elevations are 1,100 to 1,350 meters. Average annual rainfall is 200 millimeters, and the mean monthly temperature varies between 11 and 28 degrees Centigrade.

A "Laboratory of the Desert" has been constructed which provides excellent support facilities for scientific endeavors. Several institutions (foreign and domestic) are already undertaking a large number of studies. A number of publications have been completed concerning this work.

After the International Seminar, a group of interested participants traveled by special bus to Gomez Palacio. The following day, participants were transported to Mapimi by small airplane. Two days were spent in journeys on the Reserve, led by Dr. Halffter and other scientists who explained studies of herpetofauna, ecophysiology of dominant reptile species, the biology of the desert tortoise, the biology of raptorial birds, and the regeneration of desert vegetation after overgrazing, fire, and various types of human activity (fig. 1). Also included in the experience was a desert sandstorm which truly lived up to Dr. Halffter's statement that (Some of the desert storms at Mapimi are very impressive!"

LA MICHILIA BIOSPHERE RESERVE

La Michilia is a large plateau 145 kilometers southeast of the city of Durango. The Reserve

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Figure 1.--Visit to Mapimi Biosphere Reserve.

Figure 2.--Visit to La Michilia Biosphere Reserve.

encompasses 42,000 hectares, 7,000 hectares of which are an integral preserve with the remaining 35,000 hectares a buffer area. In the buffer area, livestock grazing and controlled harvesting of timber is permitted, while complete legal protection of flora and fauna exists within the preserve.

Pine-oak forests constitute a major vegetative type, with juniper-oak woodlands and grasslands comprising other vegetative types found on differing topographic areas. Elevations range from 2,250 to 2,600 meters; on two sides, mountains rise to 2,850 meters. Soils, mostly clay and sand, are derived, in part, from igneous rock. Creeks and temporary lakes constitute the water sources. Precipitation averages 500 to 700 millimeters per year, and temperatures fluctuate from 12 to 28 degrees Centigrade.

La Michilia Biosphere Reserve has had little development. To date, scientific research in the preserve has centered around studies of flora and fauna, while other studies have been conducted on cattle development and range management, industrial use of regional products of agriculture, new crops to utilize the labor force, investigation of food sources, and improvement of sanitary conditions. Some of the research findings have been summarized in various publications.

During a two-day visit to La Michilia following the seminar, 16 participants, lead by Sonia Gallina and Exequiel Ezcurra of the Institute de Ecologia, visited areas set aside for baseline investigations of: vegetative composition and growth patterns; white-tailed deer biology and habitat requirements; range management and cattle development; small rodent and reptile population densities; and water development and transfer systems (fig. 2). These investigations and others are being conducted under the direction of scientists at the Institute of Ecology, Mexico City, and to furnish a basis for the assessment of man's impacts on the environment.

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The objective of this seminar was to promote international cooperation among natural resources policy makers, scientists, and educators within the framework of the international Man and the Biosphere program. Included are 20 invited and volunteer papers, plus a summary of visits to La Michilia and Mapimi Biosphere Reserves.

Rocky Mountains

Southwest

Great Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

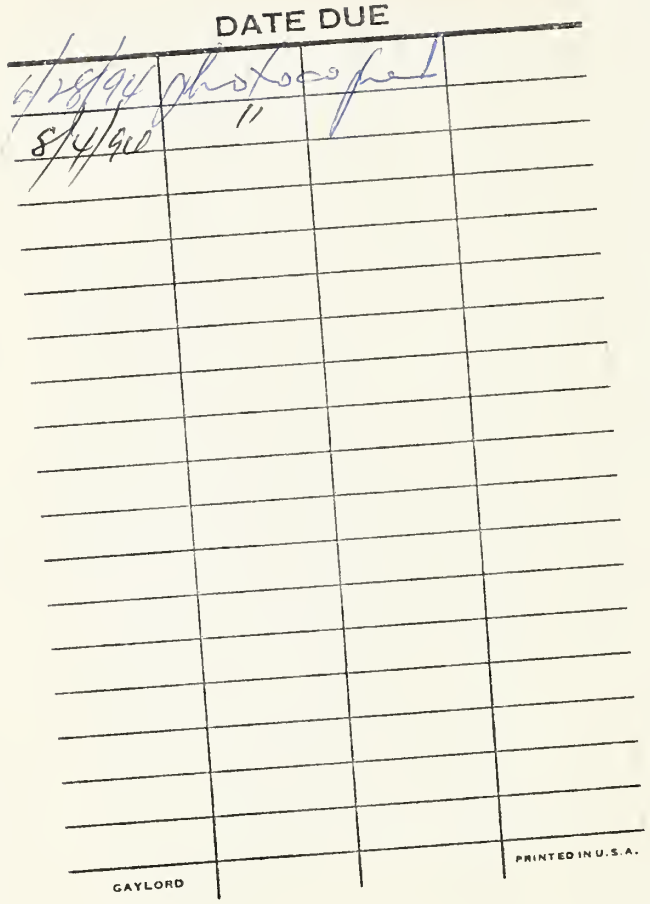
Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Bottineau, North Dakota
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Lubbock, Texas
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526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